Vol. 8 No. 6
March 31, 1983

Energy Research Abstracts

Abstracts 11579-13571

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Telephone (615) 576-1303; (FTS) 626-1303.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $6.00, foreign $7.50 per copy; annual cumulative index, domestic $10.00, foreign $12.50 per copy. The annual subscription price is $70.00 for domestic subscribers and $87.50 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $150.00 for domestic subscribers and $187.50 for foreign subscribers. A single issue costs $6.50 (domestic) or $8.15 (foreign).

The following publications are available to the public on a subscription basis from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic subscribers and $150.00 for subscribers outside the North American continent, except as listed below for *DOE Patents Available for Licensing (PAL)*. A single issue is $7.00 (domestic) and $14.00 (outside the North American continent).

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Fossil Energy Update (FEU)

A monthly abstract journal devoted to information on the processing and use of fossil fuels. Available as PB83-914600.

Fusion Energy Update (CFU)

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB83-915300.

Solar Energy Update (SEU)

A monthly abstract journal devoted to information on the utilization of solar energy, including biomass and tidal and wind power. Available as PB83-914500.

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Geothermal Energy Technology (GET)

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A semimonthly current awareness bulletin covering all aspects of the nuclear fuel cycle, both front end and back end. Available as PB83-913400.

Nuclear Reactor Safety (NRS)

A semimonthly current awareness bulletin covering the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures. Available as PB83-913500.

Radioactive Waste Management (RWM)

A semimonthly current awareness bulletin covering the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers. Available as PB83-902900.

INTERNATIONAL ENERGY PUBLICATIONS

The Technical Information Center cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U.S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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Vol. 8, No. 6
ISSN: 0160-3604
CODEN: ERAB
March 31, 1983

ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to catalog official DOE issue-and-policy documents, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $150.00 for domestic subscribers and $187.50 for foreign subscribers. A single issue costs $6.50 (domestic) or $8.15 (foreign). The cumulative indexes will be available in microfiche form only. The microfiche may be purchased from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37830.

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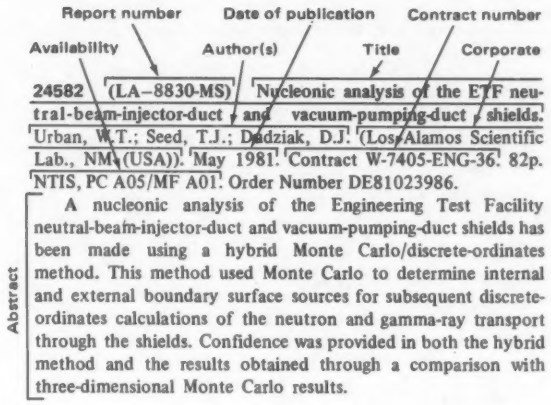
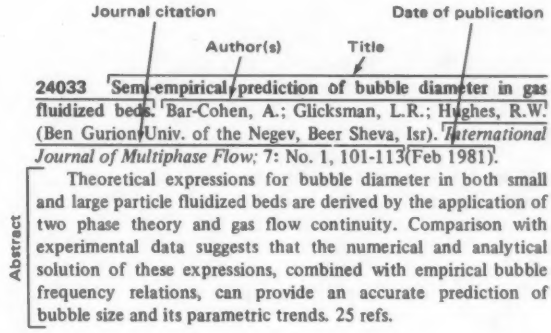
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.



24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.



24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr). *International Journal of Multiphase Flow;* 7: No. 1, 101-113 (Feb 1981).

Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA).* Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033 (J:US)
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
Neutral Atom Beam Injection
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)
Neutron Transport
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	6:24582	LA–8830-MS

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number–Report Number Correlation is included for convenience.

LA–		
8830-MS	6:24582	NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

01 COAL AND COAL PRODUCTS
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Effects
- 09 Artificial Stimulation, Plowshare, etc.
- 10 Policy, Legislation, and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves
- 02 Exploration
- 03 Mining
- 04 Feed Processing
- 05 Enrichment
- 06 By-Products
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing and Economics
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Regulations

06 FUSION FUELS
- 01 Sources
- 02 Processing
- 03 By-Products
- 04 Transport and Storage
- 05 Health and Safety
- 06 Regulations and Policy
- 07 Waste Management
- 08 Properties
- 09 Environmental Aspects

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Plants
- 07 Solar Thermal Power Plants
- 08 Ocean Thermal Gradient Power Plants
- 09 Solar Radiation Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology, Hydrology, and Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects

15 GEOTHERMAL ENERGY (CONT.)
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 07 By-Products
- 08 Geothermal Power Plants
- 09 Geothermal Engineering
- 10 Direct Energy Utilization
- 20 Geothermal Data and Theory

16 TIDAL POWER
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 07 Tidal Power Plants
- 08 Wave Energy Converters

17 WIND ENERGY
- 01 Availability (Climatology)
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING
- 01 Power Plants and Power Generation
- 02 Environmental Aspects
- 03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 05 Power Reactors, Breeding
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 07 Regulation and Licensing
- 08 Economics
- 09 Process Heat Reactors

22 NUCLEAR REACTOR TECHNOLOGY
- 01 Theory and Calculation
- 02 Components and Accessories
- 03 Fuel Elements
- 04 Control Systems
- 05 Environmental Aspects
- 06 Research, Test, and Experimental Reactors
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety

25 ENERGY STORAGE
- 01 Magnetic
- 02 Compressed Gas
- 03 Pumped Hydro
- 04 Capacitor Banks
- 05 Flywheels
- 06 Thermal
- 07 Liquefied Gas
- 08 Chemical
- 09 Batteries

29 ENERGY PLANNING AND POLICY
- 01 Energy Analysis and Modeling
- 02 Economics and Sociology
- 03 Environment, Health, and Safety
- 04 Natural Resources
- 05 Research, Development, Demonstration, and Commercialization
- 06 Nuclear Energy
- 07 Transport and Storage
- 08 Waste Heat Utilization
- 10 Conservation
- 20 Supply, Demand, and Forecasting
- 30 Policy, Legislation, and Regulation
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 60 Electric Power
- 80 Consumption and Utilization
- 90 Unconventional Sources and Power Generation

30 ENERGY CONVERSION
- 01 MHD Generators
- 02 EHD Generators
- 03 Thermoelectric Generators
- 04 Thermionic Converters
- 05 Fuel Cells
- 08 Electromechanical Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 02 Transportation
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 01 Internal Combustion Engines
- 02 External Combustion Engines
- 03 Electric-Powered Systems
- 04 Hybrid Systems
- 05 Flywheel Propulsion
- 06 Vehicle Design Factors
- 07 Emission Control
- 08 Alternative Fuels

36 MATERIALS
- 01 Metals and Alloys
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 04 Polymers and Plastics
- 06 Other Materials

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 04 Electrochemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry
- 08 Combustion Chemistry

42 ENGINEERING
- 01 General Engineering
- 02 Facilities and Equipment
- 03 Lasers
- 04 Heat Transfer and Fluid Flow
- 05 Materials Testing

42 ENGINEERING (CONT.)
- 06 Safety Engineering
- 07 Vacuum Engineering
- 08 Electronic Circuits and Devices
- 09 Waste Processing Plants and Equipment
- 10 Combustion Systems
- 20 Underground Engineering
- 30 Marine Engineering
- 40 Pollution Control Equipment
- 50 Power Cycles

43 PARTICLE ACCELERATORS
- 01 Design, Development, and Operation
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 03 Auxiliaries and Components
- 04 Storage Rings

44 INSTRUMENTATION
- 01 Radiation Instrumentation
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 03 Miscellaneous Instruments
- 04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 02 Nuclear
- 03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements

55 BIOMEDICAL SCIENCES, BASIC STUDIES
01 Behavioral Biology
02 Biochemistry
03 Cytology
04 Genetics
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicity
04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
01 Geology and Hydrology
02 Geophysics
03 Mineralogy, Petrology, and Rock Mechanics
04 Geochemistry
05 Oceanography

64 PHYSICS RESEARCH
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

65 PHYSICS RESEARCH (CONT.)
10 Nuclear Physics
40 Radiation and Shielding Physics
50 Medical Physics
60 Solid State Physics
70 Theoretical Physics
80 Mathematical Physics
90 Communication, Education, History, and Philosophy

70 FUSION ENERGY
01 Plasma Research
02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law
05 Civilian Defense

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 08 Alternative Fuels
- 03 Electric-Powered Systems
- 07 Emission Control
- 02 External Combustion Engines
- 05 Flywheel Propulsion
- 04 Hybrid Systems
- 01 Internal Combustion Engines
- 06 Vehicle Design Factors

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 03 Chemicals Metabolism and Toxicity
- 04 Other Environmental Pollutant Effects
- 01 Radiation Effects
- 02 Thermal Effects

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 30 Agriculture and Food Technology
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 06 Medicine
- 05 Metabolism
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 08 Combustion Chemistry
- 04 Electrochemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry

01 COAL AND COAL PRODUCTS
- 05 By-Products
- 40 Combustion
- 09 Environmental Aspects
- 60 Health and Safety
- 50 Marketing and Economics
- 20 Mining
- 04 Processing
- 06 Properties
- 70 Regulations
- 10 Reserves and Exploration
- 30 Transport and Handling
- 08 Waste Management

20 ELECTRIC POWER ENGINEERING
- 02 Environmental Aspects
- 01 Power Plants and Power Generation
- 03 Power Transmission and Distribution

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 09 Education and Public Relations
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 02 Transportation

30 ENERGY CONVERSION
- 02 EHD Generators
- 08 Electromechanical Converters
- 05 Fuel Cells
- 01 MHD Generators
- 04 Thermionic Converters
- 03 Thermoelectric Generators

29 ENERGY PLANNING AND POLICY
- 10 Conservation
- 80 Consumption and Utilization
- 02 Economics and Sociology
- 60 Electric Power
- 01 Energy Analysis and Modeling
- 03 Environment, Health, and Safety
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 04 Natural Resources
- 06 Nuclear Energy
- 30 Policy, Legislation, and Regulation
- 05 Research, Development, Demonstration, and Commercialization
- 20 Supply, Demand, and Forecasting
- 07 Transport and Storage
- 90 Unconventional Sources and Power Generation
- 08 Waste Heat Utilization

25 ENERGY STORAGE
- 09 Batteries
- 04 Capacitor Banks
- 08 Chemical
- 02 Compressed Gas
- 05 Flywheels
- 07 Liquefied Gas
- 01 Magnetic
- 03 Pumped Hydro
- 06 Thermal

42 ENGINEERING
- 10 Combustion Systems
- 08 Electronic Circuits and Devices
- 02 Facilities and Equipment
- 01 General Engineering
- 04 Heat Transfer and Fluid Flow
- 03 Lasers
- 30 Marine Engineering
- 05 Materials Testing
- 40 Pollution Control Equipment
- 50 Power Cycles
- 06 Safety Engineering
- 20 Underground Engineering
- 07 Vacuum Engineering
- 09 Waste Processing Plants and Equipment

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

53 ENVIRONMENTAL–SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements
- 01 Social and Economic Studies

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 03 Explosion Detection
- 02 Nuclear

70 FUSION ENERGY
- 02 Fusion Power Plant Technology
- 01 Plasma Research

06 FUSION FUELS
- 03 By-Products
- 09 Environmental Aspects
- 05 Health and Safety
- 02 Processing
- 08 Properties
- 06 Regulations and Policy
- 01 Sources
- 04 Transport and Storage
- 07 Waste Management

99 GENERAL AND MISCELLANEOUS
- 05 Civilian Defense
- 03 Information Handling
- 04 Law
- 01 Management
- 02 Mathematics and Computers

58 GEOSCIENCES
- 04 Geochemistry
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 05 Oceanography

15 GEOTHERMAL ENERGY
- 07 By-Products
- 10 Direct Energy Utilization
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 02 Geology, Hydrology, and Geothermal Systems
- 20 Geothermal Data and Theory
- 09 Geothermal Engineering
- 03 Geothermal Exploration and Exploration Technology
- 08 Geothermal Power Plants
- 04 Legal and Institutional Aspects
- 01 Resource Status and Assessment

57 HEALTH AND SAFETY

13 HYDRO ENERGY
- 05 Economics and Management
- 06 Environmental Aspects
- 03 Plant Design and Operation
- 07 Power Conversion Systems
- 04 Regulations and Licensing
- 01 Resources and Availability
- 02 Site Geology and Meteorology

08 HYDROGEN
- 07 By-Products
- 09 Environmental Aspects
- 06 Industrial and Commercial Use
- 04 Marketing and Economics
- 01 Production
- 08 Properties
- 05 Safety
- 02 Storage
- 03 Transport

44 INSTRUMENTATION
- 03 Miscellaneous Instruments
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 01 Radiation Instrumentation
- 04 Well Logging Instrumentation

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 03 Isotopic Power Supplies
- 01 Physical Isotope Separation
- 02 Radiation Sources

36 MATERIALS
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 01 Metals and Alloys
- 06 Other Materials
- 04 Polymers and Plastics

03 NATURAL GAS
- 09 Artificial Stimulation, Plowshare, etc.
- 40 Combustion
- 03 Drilling, Production, and Processing
- 08 Environmental Effects
- 02 Geology and Exploration
- 05 Health and Safety
- 06 Marketing and Economics
- 10 Policy, Legislation, and Regulation
- 04 Products and By-Products
- 30 Properties
- 01 Reserves
- 50 Storage
- 20 Transport, Pipelines, and Handling
- 07 Waste Management

05 NUCLEAR FUELS
- 06 By-Products
- 05 Enrichment
- 30 Environmental Aspects
- 02 Exploration
- 04 Feed Processing
- 07 Fuels Production and Properties
- 40 Health and Safety
- 10 Marketing and Economics
- 03 Mining
- 50 Regulations
- 01 Reserves
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 20 Waste Management

21 NUCLEAR POWER PLANTS
- 08 Economics
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 05 Power Reactors, Breeding
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 09 Process Heat Reactors
- 07 Regulation and Licensing

22 NUCLEAR REACTOR TECHNOLOGY
- 02 Components and Accessories
- 04 Control Systems
- 05 Environmental Aspects
- 03 Fuel Elements
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety
- 06 Research, Test, and Experimental Reactors
- 01 Theory and Calculation

04 OIL SHALES AND TAR SANDS
- 06 Direct Uses and By-Products
- 03 Drilling, Fracturing, and Mining
- 10 Environmental Aspects
- 07 Health and Safety
- 08 Marketing and Economics
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 20 Regulations
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 09 Waste Research and Management

09 OTHER SYNTHETIC AND NATURAL FUELS
02 Alcohol Fuels
06 Gaseous Waste Fuels
01 Hydrocarbon Fuels
03 Inorganic Hydrogen Compound Fuels
05 Liquid Waste Fuels
04 Solid Waste Fuels

43 PARTICLE ACCELERATORS
03 Auxiliaries and Components
02 Beam Dynamics, Field Calculations, and Ion Optics
01 Design, Development, and Operation
04 Storage Rings

02 PETROLEUM
50 Combustion
03 Drilling and Production
09 Environmental Aspects
02 Geology and Exploration
06 Health and Safety
07 Marketing and Economics
10 Policy, Legislation, and Regulation
04 Processing
05 Products and By-Products
30 Properties
01 Reserves
40 Storage
20 Transport, Pipelines, and Handling
08 Waste Management

64 PHYSICS RESEARCH
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

65 PHYSICS RESEARCH (CONT.)
90 Communication, Education, History, and Philosophy
80 Mathematical Physics
50 Medical Physics
10 Nuclear Physics
40 Radiation and Shielding Physics
60 Solid State Physics
70 Theoretical Physics

14 SOLAR ENERGY
03 Economics
04 Environmental, Legal, and Institutional Aspects
20 Heat Storage
08 Ocean Thermal Gradient Power Plants
06 Photovoltaic Power Plants
01 Resources and Availability
10 Solar Collectors and Concentrators
05 Solar Energy Conversion
09 Solar Radiation Utilization
07 Solar Thermal Power Plants

16 TIDAL POWER
04 Economics
05 Environmental Aspects
03 Regulations
07 Tidal Power Plants
08 Wave Energy Converters

17 WIND ENERGY
01 Availability (Climatology)
04 Economics
05 Environmental Aspects
03 Regulations
06 Wind Energy Engineering

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

ORDER NUMBER CORRELATION

ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 11998

11570 (DOE/ET/10159—T25) Fifth technical contractors' conference on peat. (UOP/SDC, Joint Venture, McLean, VA (USA)). 1982. Contract AC01-78ET10159. 422p. (TR—82/031-005; CONF-820453—). NTIS, PC A18/MF A01. Order Number DE83002171.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Portions of document are illegible.

The Fifth Technical Contractors' Conference on Peat was held April 28 to 29, 1982, at Bethesda, Maryland. Thirty papers have been entered into EDB and ERA; two had been entered previously from other sources. (LTN)

11580 (DOE/ET/10159—T25, pp 1-29) Peat research in Finland. Asplund, D. (Technical Research Center of Finland, Jyvaeskylae). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Peat research in Finland involves survey of peat deposits, harvesting, drying, pelletizing, carbonization, combustion, fluidized-bed combustion, gasification, liquefaction, etc. All of these items are described briefly. (LTN)

11581 (GFETC/IC—82/1, pp 15-24) Coal: the refocused federal program. Legassie, R.W.A. (Dept. of Energy, Washington, DC). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Coal is our most abundant domestic energy resource - and it is a resource we can and must begin to use increasingly. Government mechanisms to stimulate the increased use of coal are moving away from large infusions of direct Federal funds and toward efforts to bring rational order to the regulatory process, to create a more vigorous private marketplace, and where needed, to act as a safety net for first-of-a-kind projects. Present coal combustion technology is effective and affordable, several improved technologies are at the commercial threshold. Construction of the nation's first large commercial synthetic fuels plant, which will convert lignite to synthetic natural gas, is to begin wit' in weeks backed by an anticipated $2 billion Federal loan guarantee. The newly-created US Synthetic Fuels Corporation has taken its first steps to begin assisting commercial and near-commercial synthetic fuel projects. Export of US coal is playing an increasingly important role in world energy patterns and is projected to become a significant factor in helping to stabilize the international energy situation and in restoring the nation's trade balance. In these areas, the private sector is beginning to seize the initiative, and DOE therefore can channel its funds more properly toward longer-range, higher risk R and D.

11582 (GFETC/IC—82/1, pp 25-47) RD and D initiatives for low-rank coals: follow-up to the low-rank coal study. Wiltsee, G.A.; Kotowski, J.A. 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The Low-Rank Coal Study was initiated in 1979 by Grand Forks Energy Technology Center DOE to contribute to the development of very large US resources of subbituminous coal, lignite, and peat. The study recommendations call for a national program of research, development, and demonstration by industry and government to: (1) improve the quality and marketability of low-rank coals by appropriate use of preparation and upgrading technologies and transportation systems; and (2) to advance the utilization technology by improving operability, efficiency, and economics of combustion systems, synthetic fuels processes, and environmental control technology. GFETC has been making progress on the definition and implementation of a more coordinated program of R and D with industry and academia. This involves a series of workshops focusing on the best available expertise from all affected sectors of government, industry, and academia, on questions derived from the Low-Rank Coal Study pertaining to R and D needs, applications, task definitions, methods, and performance qualifications. The intended outcome of this effort is to provide guidelines for a coordinated RD and D program devoted to the advancement of low-rank coal technology, with each government and private sector organization playing a role suited to its capabilities and motivations.

11583 (ORNL—5923) Fossil-energy program. Quarterly progress report for the period ending September 30, 1982. McNeese, L.E. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 339p. NTIS, PC A15/MF A01. Order Number DE83004692.

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This quarterly report covers the progress made during the period July 1 through September 30 for the Oak Ridge National Laboratory research and development projects that are carried out in support of the increased utilization of coal and other fossil fuels as sources of clean energy. These projects are supported by various parts of DOE including Fossil Energy, Basic Energy Sciences, Office of Health and Environmental Research, Office of Environmental Compliance and Overview, the Electric Power Research Institute, and by the Tennessee Valley Authority and the EPA Office of Research and Development through inter-agency with the DOE.

0104 Processing

REFER ALSO TO CITATION(S) 11670, 11670, 11673, 11675, 11681, 11681, 11682, 11691, 11718, 11719, 11724, 11742, 11755, 11767, 11772, 11772, 11774, 11774, 11775, 11775, 11776, 11776, 11777, 11777, 11778, 11778, 11785, 11786, 11786, 11960, 11963, 11983, 11989, 12090, 12269, 12280, 12492, 12537, 12538, 12616, 12774, 12774

11584 (CONF-8108141—) Eighth annual international conference on coal gasification, liquefaction, and conversion to electricity. Brainard, A.J. (ed.). (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Mar 1982. 494p. NTIS, PC A21/MF A01. Order Number DE82905463.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Portions of document are illegible.

The eighth annual international conference on coal gasification, liquefaction, and conversion to electricity was held at the Department of Chemical & Petroleum Engineering, University of Pittsburgh, Pittsburgh, Pennsylvania. Thirty-three papers have been entered individually into EDB and ERA. (LTN)

11585 (CONF-8108141—, pp 41-64) Shell coal gasification process. McCullough, G.R. (Westhollow Research Center, Houston, TX); van der Burgt, M.J.; Waller, J. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The entrained Shell Coal Gasification Process operating under slagging conditions and elevated pressure features: practically

complete gasification of most coals; high reactor throughput; high thermal efficiency and efficient heat recovery; production of a clean gas without byproducts; and environmental advantages. The present paper highlights the environmental aspects of the process: gas treating; methods to maximize slag production; slag leaching; uses for waste material; and water treating. There are numerous possible future applications for this process. The gas produced (93 to 98%v hydrogen and carobn monoxide) is suitable for the manufacture of hydrogen or reducing gas and, with further processing, substitute natural gas (SNG). Moreover, the gas can be used for the synthesis of ammonia, methanol and liquid hydrocarbons. Another possible application of this process is as an integral part of a combined-cycle power station featuring both gas and steam turbines. Such integration of a Shell coal gasifier with a combined-cycle power station will allow for electricity generation at 42 to 45% efficiency for a wide range of feed coals. The development program includes the operation of a 150 t/d gasifier at Deutsche Shell's Harburg refinery since November 1978 and of a 6 t/d process development unit at Royal Dutch Shell's Amsterdam laboratories from December 1976 onwards. The next step will be the construction and operation of 1000 to 2000 t/d prototype plants which are scheduled for commissioning in 1985/86.

11586 (CONF-8108141—, pp 65-78) **KBW: improvements on a well-known process.** Dokuzoguz, H.Z. (KBW Gasification Systems, Inc., Pittsburgh, PA); Michaels, H.J.; Probert, P.B. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

As contrasted to the fixed bed and fluidized bed gasification processes the entrained flow KBW gasification process has the following advantages: it can gasify any rank of coal; it an treat 100% of the mine output; it has a high capacity; it has major environmental advantages; and it does not produce methane. KBW is structured to provide single-source capability for turnkey, entrained flow coal gasification plants worldwide from initial feasibility studies through start up of the completed plant. The KBW coal gasification system is based on proven capabilities of Koppers and Babcock & Wilcox in entrained flow coal gasification and in various technologies associated with the processing and utilization of coal and its products. This combination of expertise and experience enables KBW to offer a gasification system of an efficient, reliable and advanced design that utilizes modern, proven technology.

11587 (CONF-8108141—, pp 79-106) **British Gas slagging gasifier - a springboard into synfuels.** Sharman, R.B.; Lacey, J.A.; Scott, J.E. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The most developed and widely used fixed bed pressure gasification systems are based on the Lurgi Gasification Process. The British Gas/Lurgi Slagging Gasifier results from the joining together of British Gas Corporation and Lurgi Company technology. The British Gas Slagging Gasification technology offers significant advantages over dry bottom Lurgi and other fixed bed gasification systems. It is also true to claim that the slagging gasifier has more advantages than disadvantages when compared with entrained flow gasifiers and these advantages are sufficient to give it an economic advantage in most process situations. There are other fixed bed, fluidized bed and entrained flow gasifiers under development but these are not short to medium term options and only in the longer term will it become clear whether or not these developments offer sufficient economic advantage to compete with or displace the British Gas/Lurgi Slagging Gasifier. The processing of crude Slagging Gasifier gas and the multifarious uses of the resulting clean gas in the chemicals, power generation and fuel gas fields are described. The environmental impact of the process is also discussed and plans for commercialization are considered.

11588 (CONF-8108141—, pp 107-122) **Commercializatin of the Texaco coal gasification process.** Schlinger, W.G. (Texaco, Inc., Los Angeles, CA); Guptill, F.E. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

One of the principal reasons leading to the wide acceptance of the Texaco Coal Gasification Process is that of environmental acceptability. All material leaving an entrained flow slagging gasifier has been exposed to relatively high temperatures on the order of 2300°F to 2800°F. At this temperature level, partially gasified or partially oxidized carbonaceous material is extremely unstable. Therefore, the undesirable components, such as phenols, cresols and other partially oxidized or carcinogenic hydrocarbons are not found. In addition, the ability to recycle the small fraction of unconverted carbon back to the slurry feed greatly reduces the problem of by-product disposal. The second reason for the widespread process acceptance is related to the simplicity of the feed system. The coal slurry, after preparation and proper control of the size distribution of the particles in the slurry, is relatively stable and can be pumped reliably with high pressure reciprocating pumps available in commerce today. No high pressure lockhopper feed systems are required and pretreatment of the coal is seldom necessary. Thirdly, the high temperature and high pressure within the gasifier lead to rapid gasification reactions and therefore the gasifier itself is capable of relatively high throughputs per unit volume. The accelerated process development following the oil embargo in 1973 led to a large demonstration project designed for installation in Germany at the Ruhrchemie Petrochemical Complex near Oberhausen. This plant, jointly designed by Texaco, Ruhrchemie and Ruhrkohle, is rated at 165 tons per day of coal and went onstream in January of 1978. Two additional demonstration plants are now in operation.

11589 (CONF-8108141—, pp 123-140) **Recent developments in high pressure, entrained flow, slagging gasification of coal update of Bi-Gas Pilot Plant Operations.** Young, R.K. (Stearns-Roger Engineering Corp., Denver, CO). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Bi-Gas Plant operations, particularly the several tests conducted from mid-1980 to the present, have involved long-term runs under slagging conditions with minimum supplemental fuel gas. This represents a significant achievement - namely, operation of the Bi-Gas gasifier in a commercial mode. Extensive and repeated checks of redundant plant safety systems, particularly those involving gasifier Stage 1 operations, have further increased confidence in the Bi-Gas process. Durability of hardware, particularly regarding the char burners, refractory in Stage 2 of the gasifier, maintenance of the protective slag layer in Stage 1 of the gasifier, plus performance of cooling water tube material and thermocouple systems amplify the confidence in future commercial development of this type gasification system. It is anticipated that developmental work on the Bi-gas process per se will be completed by the end of Fiscal Year 1982. During the latter part of Fiscal Year 1982, plans include operation of the following downstream process units in an integrated fashion: the carbon monoxide shift unit, complete acid gas removal system, the fluidizedbed methanation system and the Claus sulfur plant. To further aid in the evaluation of future operations, we have installed a new computer-based data acquisition and process analytical system; an important tool which will be used for dynamic evaluation of all process units and for on-line computation of steady-state material and energy balances. Anticipating that the major hardware and process difficulties have been overcome, our intention is to optimize plant operations in the relatively near future so that a data base for the design of a commercial-scale Bi-gas facility can be firmly established.

11590 (CONF-8108141—, pp 141-159) **Fuel oil substitution by enriched medium Btu gas produced from coal in Winkler fluidized gasifiers.** Boegner, F. (Davy McKee AG, Cologne, Germany); Vangala, R.; Subramaniam, T.K. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Various carbonaceous materials of carbon contents up to 85 wt % and a wide range of ash types and with levels up to 50 wt % in the feedstock have been successfully gasified in commercial scale Winkler gasifiers to produce: 120 Btu/Scf low Btu gas with air blown unit; and 200 to 300 Btu/Scf medium Btu gas with oxygen blown unit. In order to achieve higher heating value any of the commercially proven coal gasification technologies require additional methane enrichment. A new development in methanation catalyst technology will allow partial methanation of the gas produced from oxygen blown gasifiers. The methane content in this gas can be increased to produce a gas with a heating value in excess of 400 Btu/Scf. A methane-enriched medium Btu gas is possible with lower capital and operating costs than those required to produce SNG.

11591 (CONF-8108141—, pp 160-170) **Coal liquids: milestones toward commercialization.** Wade, D.T. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

In our studies of alternative process, were found that variations in the bases from one study to another generally far outweigh the impact of alternative processing technologies on the economics of various alternatives. Thus, it appears that many different technologies and product slates have a potential role in future commercial projects. The author's conclusions are: direct coal liquids process developments are approaching a critical milestone, namely successful completion of the large pilot plant programs. When those programs are completed the next logical milestone is design and construction of a pioneer plant. Indirect liquefaction processes to produce methanol and Fischer-Tropsch liquids have passed the pioneer plant milestone and further development appears to depend primarily on marketplace factors. Finally, within the range of coal types available and product demand forecasts, there appears to be no single process or product which clearly dominates all other processes or products. Therefore, it is desirable to continue to pursue a broad range of process and product options.

11592 (CONF-8108141—, pp 171-190) **Exxon donor solvent coal liquefaction process: ECLP operating experience II.** Cohen, S.J.; Payne, R.E. (Exxon Co., Baytown, TX). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The operation of the Exxon Coal Liquefaction Pilot Plant (ECLP) is the keystone of an integrated program to bring the Exxon Donor Solvent (EDS) process to commercial readiness. The program is sponsored by the US Department of Energy, Exxon Company, USA, Electric Power Research Institute, Japan Coal Liquefaction Development Company, Phillips Coal Company, Arco Coal Company, Ruhrkohle AG, and AGiP. This is the second in a series of presentations covering operations of the Exxon Coal Liquefaction Pilot Plant. This presentation covers all of the operations, through the end of the testing period, as well as the results of our second turnaround. On June 2 we shut down the plant for a scheduled turnaround and thus ended our test program with Illinois coal, as well as testing of operations in a once-through mode. Exxon Research and Engineering has completed studies that show that recycling vacuum fractionator bottoms to the reaction section increases process flexibility and is the preferred method from an economic standpoint. Therefore, bottoms recycle facilities were installed during our recent turnaround, and plans are to operate in the bottoms recycle mode for the duration of our operations on sub-bituminous and lignitic coals.

11593 (CONF-8108141—, pp 191-197) **Coal liquefaction activities in West Germany.** Specks, R.; Wolowski, E. (Ruhrkohle Oil and Gas GmbH, Bottrop, Germany). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The objective of the current coal liquefaction activities in West Germany is the industrial sale production of liquid products from coal with improved economic conditions relative to the earlier technologies developed in Germany until 1945. The development has reached the stage of pilot plants, which were designed by extrapolation of laboratory plants. The capacity of these pilot plants is chosen so as to minimize the extrapolation risks for the design and construction of large scale industrial plants. The pilot plant Bottrop, based on the Bergius-Pier-Process, is designed to process 200 tons of coal (maf) a day producing 30 tons light oil (C_5 to 200°C), and 70 tons middle oil (200 to 325°C). The total investment for Phase I including commissioning is 200 m DM. Two other pilot plants are described briefly. Four commercial plants under consideration are mentioned, in deciding the necessary marketing research for their products.

11594 (CONF-8108141—, pp 219-227) **NEPA process and direct coal liquefaction constraint or opportunity.** Rogowsky, M.L. (Dept. of Energy, Washington, DC). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

NEPA imposes certain procedural burdens on the federal government. Government no longer has exclusive control over the decision-making process. Government must share with the public information concerning the potential adverse impacts associated with major and significant government activities. NEPA's procedural requirements can be time-consuming and have been viewed by some as a barrier to the speedy development of a new technology. But speed should not be the only criterion by which we judge our governmental actions. In fact, because there are significant technical barriers to the speedy development of new technologies, a propery implemented NEPA review should not become a critical path item nor should it cause delays to the technology development. It is my belief that NEPA should not be viewed as a constraint to development of direct liquefaction. The final answer as to the acceptability of synthetic fuels in the marketplace, and direct liquefaction in particular, is still several years away. However, the NEPA process has given the public a glimpse, a large glimpse, of direct liquefaction in its infancy, and public understanding and acceptance of the potential environmental consequences at this point in time will make the path to commercialization a less burdensome path to follow.

11595 (CONF-8108141—, pp 228-248) **SRC-II product applications - recent developments.** Freel, J.; Jackson, D.M. (Solvent Refined Coal International, Englewood, CO). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

During the last four years a major part of the SRC-II development effort has involved operation of a 30 ton per day SRC-II Pilot Plant at Ft. Lewis, Washington. Approximately 20,000 barrels of SRC-II distillates have been produced there, which are being utilized in product development and applications testing. This paper provides a brief review of the status of that effort. Typical yields from the SRC-II process are given in Table 1. The co-products, methane, propane and butane are, of course, traditional products of the petroleum and natural gas industries, and it is expected that they will be produced to normal industry specifications. Likewise, by-product ammonia and sulfur are conventional products which will meet industry specifications. The liquid SRC-II product is not similar to conventional liquid fuels now derived from petroleum. Table 2 compares chemical analyses of SRC-II fuel oil (350°F$^+$) with typical data for No. 2 and No. 5 fuel oils. The SRC-II product is more aromatic, and therefore has a lower hydrogen/carbon ratio. It is also substantially higher in nitrogen and oxygen. SRC-II liquids can be upgraded to conventional products. Studies conducted for the DOE, however, suggested that substantial markets could be developed for raw SRC-II fuel oil. It was projected that SRC-II fuel oil could be used as an industrial and electric utility fuel thereby freeing petroleum products for higher value applications, including refining. However, the naphtha proudced by the SRC-II process is expected to be refined, first hydrotreating to remove heteroatoms, then reforming to a high octane gasoline blendstock.

11598 (CONF-8108141—, pp 347-353) **Turn in the road: Eastman chemicals from coal.** Coover, H.W.; Hart, R.C. (Eastman Kodak Co., Kingsport, TN). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The petrochemicals industry currently utilizes petroleum and natural gas as starting materials to manufacture products valued at $56 billion annually. The industry faces a tremendous challenge in the 1980's to keep plants running both reliably and profitably while adjusting to the changing social and political environments and contending with international unrest. Fortunately, the financial rewards for good performance are equally great. Indeed, the chemical industry is at a turn in the road and the most successful companies of the 1980's may well be those which deelop new advanced technologies to move their operations toward lower cost feedstocks and fuels. With acetic anhydride, Eastman began with wood, converted to petroleum, and now is taking a new and important turn in the road by moving to coal.

11597 (CONF-8108141—, pp 437-448) **Outlook for coal synthetics: time for re-appraisal and resolve.** David, E.E. Jr. (Exxon Research and Engineering Co., Florham Park, NJ). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The infant synfuels industry has entered a period of re-appraisal. But in light of what the industry is discovering, re-appraisal is normal, necessary and in the best interests of society. For Exxon the need for synfuels remains clear. The company has so far invested about $1 billion in synfuels resources, research and commercialization worldwide. The conventional wisdom today seems to prefer Colorado shale to coal as a source for synthetic liquid fuels. But research and development stand a good chance of making coal competitive. Methanol from coal is an intriguing possibility, both as an octane-improving gasoline extender, and, eventually, as a neat automotive fuel. Pittsburgh seam coal tests out as a good coal for liquefaction via the Exxon Donor Solvent technology, now in the large pilot-plant stage. In establishing a synfuels industry, the cost-control battle in the laboratory will be as critical as the cost-control battle on the project. Catalysis is to the petroleum and chemicals industries what solid state science is to the communications industry. We might see innovation at a rate approaching that in microelectronics, with major applications to synfuel technologies, if the current rate of progress continues.

11598 (DOE/ER/71294—T2) **Preparation and characterization of ligand types intermediate in the metal catalyzed conversion of coal to methane, methanol, and higher alkanes and alcohols. Final progress report, September 1, 1978-June 30, 1982.** (California Univ., Los Angeles (USA)). 1982. Contract AT03-76ER71294. 25p. NTIS, PC A02/MF A01. Order Number DE83004402.

This report attempts to concisely summarize the contents of the approximately 25 papers which have resulted from this project. Extensive reference is made to the attached publication list. In our original proposal, we outlined a program of preparation and characterization of 4 reactive ligand types (believed to represent plausible catalyst bound intermediates in homogeneous CO reduction) on homogeneous metal centers. Complexes containing each of the 4 ligand types have been isolated during the course of this study. This report describes the accomplishments in these areas, which are: (1) transitional metal-formyl complexes; (2) hydroxylmethylidene complexes; (3) metal α-hydroxyalkyl complexes; and (4) alkylidene complexes.

11599 (DOE/ET/10069—T21) **EDS coal liquefaction process development. Phase V. ECLP industrial hygiene program. Interim report.** Epperly, W.R. (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Oct 1982. Contract FC05-77ET10069. 107p. (FE—2893-96). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83001390.

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The industrial hygiene measurements taken during shakedown and sustained operations of ECLP on Illinois No. 6 bituminous coal showed the major sources of worker exposure to be coal liquid fumes or aerosols generated by coal liquid contamination of hot pump surfaces, hot valve surfaces, saturated insulation, and vacuum bottoms cooling belt emissions. High concentrations of coal liquid fumes from these sources were found to contain small, but still significant concentrations of fourplus-ring polynuclear aromatic hydrocarbons (PNA's) including some of proven carcinogenic activity (in animal studies). Atmospheric emissions from reciprocating and some centrifugal pumps were found to be primarily hydrocarbon aerosols with very low concentrations of hydrocarbon vapors. Table 2.1 summarizes the measured exposures (BSF) to coal liquid fumes by personal sampling. Personal sampling measurements indicate inhalation exposures to be in direct proportion to emitting equipment in the job areas. The liquefaction distillation unit (LDU) job posts had the highest average exposures (0.099 mg/m^3 and 0.095 mg/m^3). Analysis of the personal samples showed a marked absence of four or more ring PNA's (generally considered carcinogenic) except in very high coal liquid fume concentrations. All samples also showed the absence of personal exposure to the primary aromatic compounds of benzene, toluene and xylene, and to the primary aromatic amines.

11600 (DOE/ET/10159—T18) **Second technical contractors' conference on peat.** (UOP/SDC, Joint Venture, McLean, VA (USA)). 1980. Contract AC01-78ET10159. 421p. (CONF-8010310—; TR—81/031-001). NTIS, PC A18/MF A01. Order Number DE83000831.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

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This conference reported the status of the US Department of Energy Peat Program. The program includes peat resource surveys of eleven states, peat gasification process and equipment studies, dewatering studies, and environmental and socioeconomic factors in the development of peat technology. Separate abstracts were prepared for selected papers. (CKK)

11601 (DOE/ET/10159—T18, pp 175-220) **Peat gasification: Rockwell international process.** Friedman, J. (Rockwell International, Canoga Park). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

Using the test facility and reactor developed for coal gasification by the Cities Service/Rockwell (CS/R) process, a study was undertaken to develop engineering data on dense-phase feeding of peat, to develop a model that would correlate reactor performance to hydrogen partial pressure, temperature, and residence time, and to assess the process economics. A review is given of the CS/R process and equipment, and then results of the study are discussed. The engineering data for dense-phase feeding of peat exhibits the classical exponential relationship between mass flux and pressure drop. An equation is given correlating reactor performance to reactor parameters which fits data from four separate gasification reactors. Three variants of the CS/R process for peat gasification are described and an economic analysis given which shows that the coproduction of SNG and benzene would significantly improve the economics. (CKK)

11602 (DOE/ET/10159—T18, pp 221-238) **Peat gasification: low-severity hydropyrolysis.** Paganessi, J.E.; Duncan, D.A.; Mensinger, M.C.; Punwani, D.V. (Inst. of Gas Tech., Chicago, IL). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

The results are described of a study undertaken to determine the effects of temperature (1000 to 1500°F) and hydrogen partial pressures (250 to 500 psia) on the composition and yield of hydrocarbon liquids from the pyrolysis of peat. Tests were conducted with Minnesota peat in an entrained-flow hydrogasification process development unit modified to improve liquid collection efficiency. Graphs are presented showing the changing composition of hydrocarbons with temperature and pressure changes. Low severity hydropyrolysis of peat offers a flexibility in the relative yields of light

hydrocarbon gases (C_1 and C_2) and oils C_3^+). These yields are more sensitive to operating temperature than to hydrogen partial pressure and more sensitive in hydrogen atmospheres than in steam. (CKK)

11603 (DOE/ET/10159—T18, pp 239-259) **Peat pretreatment: High-pressure wet carbonization.** Mensinger, M.C.; Punwani, D.V. (Inst. of Gas Tech., Chicago, IL). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

In wet carbonization processes, wet peat is heated under pressure at residence times that are severe enough to break carboxyl and hydroxyl groups and disrupt the colloidal nature of the peat so as to improve its dewaterability and its heating value. Results are reported on a study of Minnesota, North Carolina, and Maine peats which was undertaken to determine the effects of wet carbonization operating conditions on process yields and mechanical dewatering of the peats. Tests were conducted within the following ranges of operating conditions: 365 to 610°F; 315 to 2200 psia; and 5 to 80 minutes. Results are presented in graphs and show that the enhancement of dewaterability, gas yield, and heating value increases with process temperature and residence time. No results are presented for pressure variations. Gasification tests with the three peats showed that wet carbonized peat has lower reactivity than raw peat, but is still significantly higher than that of bituminous coal char. Future work will concentrate on the process design of peat wet carbonization and the analysis of the economics. (CKK)

11604 (DOE/ET/10159—T18, pp 261-265) **Single-stage fluidized-bed gasification.** Pyrcioch, E.J.; Punwani, D.V. (Inst. of Gas Tech., Chicago, IL). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

The status of a study to obtain data for the design of a single-stage fluidized-bed gasifier using steam and oxygen is discussed. Modifications to an existing steam/oxygen gasifier are described. To date, two tests have been conducted with Minnesota peat, each lasting over two hours of operating time. No results are presented. (CKK)

11605 (DOE/ET/10159—T18, pp 267-283) **Preparation for pilot plant scale peat gasification tests.** Biljetina, R.; Punwani, D.V. (Inst. of Gas Tech., Chicago, IL). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

The US Department of Energy and the Gas Research Institute have initiated a pilot-plant-scale program to advance peat gasification technology. An existing HYGAS pilot plant facility for coal gasification was converted to peat gasification. This paper reports on the modifications which were made to the pilot plant, the new equipment that was purchased, and the lockhopper system which was designed for feeding the peat to the gasifier. (CKK)

11606 (DOE/ET/10159—T18, pp 285-293) **Comparative analysis of peat gasification reactor configurations.** Kuo, D.M. (UOP, Inc./System Development Corp., McLean, VA). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

A study was undertaken to establish a basis for recommending a peat gasification reactor configuration to the US Department of Energy for a pilot plant. Peat gasification data from the Institute of Gas Technology and Rockwell International were evaluated, a regression analysis done, and upstream and downstream equipment requirements were analyzed. Mathematical models and computer progams were developed to simulate the entrained-bed and fluidized-bed reactors, and a parametric analysis was made. The data analysis could establish only one peat gasification parameter: temperature. Only indications of trends could be established for other variables because of inadequate data. The results of the computerized simulations are discussed, especially hydrogen production versus residence times and predicted yields versus reactor configurations. (CKK)

11607 (DOE/ET/10159—T18, pp 295-321) **Continued development of a peat biogasification process.** Ruoff, C.F.; Ashare, E.; Sanderson, J.E.; Wise, D.L. (Dynatech R/D Company, Cambridge, MA). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

The anaerobic digestion of peat by-passes the main obstacle in producing energy from peat, namely, the high water content. A process is described in which the peat is hydraulically mined and the slurry pumped to storage lagoons. The peat is thermochemically treated with Na_2CO_3 to solubilize the organic matter in peat, then oxidized into a mixture of water soluble aromatic compounds which are anaerobically biodegraded into CH_4 and CO_2. A pipeline quality SNG results after scrubbing out the CO_2 and residual H_2S. This paper describes the work and results of a study to develop a process model that describes the complex reactions that occur in the three phases (hydrolysis, oxidation, and anaerobic digestion) of peat gasification. The solubization phase could be carried out at relatively low temperatures (< 150°C) and in relatively short times (< 30 min). Further work is necessary to describe the parameters affecting the oxidation stage, i.e., temperature, oxygen partial pressure, and retention time. Water soluble aromatic compounds in the cooked peat liquor were found to undergo nearly complete conversion to fuel gas, while untreated peat showed negligible conversion. (CKK)

11608 (DOE/ET/10159—T25, pp 147-154) **High pressure wet carbonization of peat.** Wall, B.D.; Lau, F.S.; Punwani, D.V. (Inst. of Gas Tech., Chicago, IL). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Wet-carbonization is a thermochemical process normally associated with peat that is designed to alter the physical and chemical nature of a carbonaceous material. It involves heating a peat-water slurry at elevated pressures to disrupt the colloidal nature of the feed material by breaking the carboxyl and hydroxyl groups from its molecular structure. Disrupting the peat's colloidal nature improves the feed materials' dewaterability. Breaking of carboxyl and hydroxyl groups removes oxygen from the peat as water and carbon oxides, thus enhancing the heating value of the final product. The advantages of wet carbonization are: the mechanical dewaterability of peat is improved (raw peat can be mechanically dewatered to only about 70% moisture, whereas wet-carbonized peat can be mechanically dewatered to as low as 30% moisture); peat's heating value is chemically upgraded (the heating value for raw fuel grade peat can be as low as 8000 Btu/lb on a dry basis, whereas the heating value for wet-carbonized peat could be as high as 13,000 Btu/lb on a dry basis); wet-carbonized peat can be sold as a high-Btu, low-sulfur solid fuel for boilers (a substitute for bituminous coal, which is high in sulfur and requires stack gas scrubbing); wet-carbonized peat can be transported longer distances more economically than low-Btu lignite and subbituminous coal; wet carbonized peat could be used to produce useful chemical feedstocks such as ethyl alcohol, acetic acid and furfural; and wet-carbonized peat can be readily utilized in gasification processes, resulting in reduced size and cost for lockhopper feed and acid-gas removal systems.

11609 (DOE/ET/10159—T25, pp 163-186) **Peatgas pilot plant status.** (Inst. of Gas Tech., Chicago, IL). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Pilot plant tests of the PEATGAS process resulted in a number of significant achievements: Gasifier operating data were collected during three different operating phases at 500 psig and at varying peat moisture contents; fully integrated plant operation using peat with a 30 to 35-weight-percent moisture content was demonstrated (operation of feed preparation, lockhopper, and gasifier systems was smooth and reliable with high-moisture-content peat feed); lockhopper sequencing control was switched from level indication to weight indication during the test to demonstrate a new control method; and PT-5 was the most successful test to date, resulting in over 200 total tons of dried peat being fed to the gasifier at rates up to 3 ton/h. The successful pilot plant program re-

sulted in an extensive data base. A wide range of operating conditions was covered to study the effect of major gasifier parameters on product yield and composition. Thus, the technical feasibility of the PEATGAS process has been demonstrated on a pilot plant scale. The data obtained represent a significant data base for scale-up to commercial operation. Additional data are desirable at steam/carbon ratios of 0.7 and at higher hydrogasifier temperatures (up to 1400°F), which will maximize the production of methane in the gasifier and improve oil quality. These data could further improve the economics of the PEATGAS process. The experience gained, to date, has shown that peat is highly reactive and an excellent feed material for hydrogasification to SNG.

11610 (DOE/ET/10159—T25, pp 189-217) **Hydrogasification of peat.** Kahn, D.R.; Garey, M.P. (Rockwell International, Canoga Park). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Rockwell became involved in peat hydrogasification process development as a result of its ongoing program in coal hydrogasification. In this process, a short-residence-time, noncatalytic, entrained flow reactor scheme is employed to conduct the direct hydrogenation of coal, or peat, with heated hydrogen. The Rockwell FHP reactor is derived from aerospace rocket reactor technology. A rocket-type injector sprays impinging jets of hot hydrogen, at about 2000°F, and pulverized coal into the reactor. Rapid mixing followed by rapid reaction occurs, and within a few seconds, SNG and other products are formed. It is desirable to inject the pulverized coal or peat with a minimum of carrier gas in order to minimize the amount of heat the hot hydrogen has to carry into the reactor. This is accomplished by dense-phase feeding, a technique developed at Rockwell which allows the transport of pulverized coal or peat with just enough carrier gas to fill the interstices between the coal particles. Preliminary process design and economic studies have been performed for several 250-billion Btu/day SNG-from-peat plants using data obtained from Rockwell hydrogasification test runs. Average gas costs as low as $2.02/MMBtu have been calculated in first-quarter 1980 dollars assuming utility-type financing and a peat cost of $0.75/MMBtu. An important factor in obtaining these attractive results is the coproduction of high-value chemical-grade benzene. Key results of the process design and economic studies are summarized.

11611 (DOE/ET/10159—T25, pp 367-374) **Comparative analysis of peat gasification reactor configurations.** Kuo, D.M. (UOP, Inc./System Development Corp., McLean, VA). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

A preferred reactor configuration should provide flexibility in: (1) capability to balance overall carbon conversion for adequate char yield for required hydrogen production, (2) capability to provide high hydrocarbon gas (primarily methane) formation in the gasifying reactor for SNG production, (3) capability to provide high hydrocarbon liquid production in the gasifying reactor when gas demand is low, and (4) capability to handle changes in peat feed properties. The reactor configuration should exhibit low severity operating conditions in temperature, total pressure, hydrogen partial pressure, and residence time. This will minimize design temperature and pressure requirements and lessen metallurgical requirements. The system design should be simple in scale-up and layout. Further, the system should exhibit responsive controllability via the significant process variables. Economic tradeoff and risk assessments must be performed before a selection of a specific reactor configuration can be made. This review and analysis concentrates primarily on the PEATGAS process of IGT and the Rockwell International Hydrogasification Process. The two-state PEATGAS process appears to have advantages in higher thermal efficiency (an estimated 66% for PEATGAS versus an estimated 59.4% by Rockwell International) and stronger support in its application of existing commercial operations and proven design practices from other types of fluidized solids processing units. Certain other differences are considered in the text.

11612 (DOE/ET/10555—T1) **Kinetics and mechanism of desulfurization and denitrogenation of coal-derived liquids. Final report, June 1975-January 1979.** Gates, B.C.; Katzner, J.R.; Olson, J.H.; Kwart, H.; Stiles, A.B. (Delaware Univ., Newark (USA)). Jul 1982. Contract AC01-76ET10555. 26p. NTIS, PC A03/MF A01. Order Number DE83005307.

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The refining of coal-derived liquids and, especially, the removal of harmful sulfur and nitrogen is of great scientific and practical importance. The research planned under this contract has been completed: detailed results have been provided in the fourteen quarterly reports previously issued. Brief statements concerning the status of the following tasks are presented; microreactor development; catalytic hydrodesulfurization; hydrogenation, hydrodenitrogenation reactions; reaction engineering; and characterization of aged hydroprocessing catalysts.

11613 (DOE/ET/10587—T1-Pt.3) **Relation of coal characteristics to liquefaction behavior. Final technical report, July 1976 to February 1981. Part III. Mechanistic studies, product distributions and supportive analytical investigations .** Given, P.H.; Spackman, W.; Davis, A.; Walker, P.L.; Lovell, H.L.; Coleman, M.M.; Painter, P.C. (Pennsylvania State Univ., University Park (USA). Coal Research Section). 1981. Contract AC22-76ET10587. 117p. (FE—2494-FR-3). NTIS, PC A05/MF A01. Order Number DE83004597.

In this report, a number of mechanistic aspects of liquefaction are addressed that may be dependent on coal characteristics, then product composition is considered, and after that various supportive studies of an analytical character and reported. Finally, some statistical correlations are considered that permit some degree of prediction of the distillability of products from the characteristics of the coal used as feedstock. Correlations between coal characteristics and liquefaction conversion in tetralin are somewhat perturbed when the reactor system is pressurized with hydrogen, apparently because additional mass transport limitations become significant and the severity of these varies from coal to coal. Different specimens of pyrite isolated from coals promote liquefaction to differing extends when added to low-sulfur coals. A new kinetic model for coal liquefaction recognizes that many components are reacting simultaneously and shows that the effective temperature coefficient varies with the extent of conversion in the early stages of the process. The interaction of hydrocarbon solvents with coals turns out to be an unexpectedly complex phenomenon, and it is still not known how donor solvent rapidly penetrates coal particles under liquefaction conditions, as it is commonly assumed to do. However, there are indications that imbibition is operative. Consistently with this, hydrocarbons cause some swelling of lower rank coals. Hexane-soluble oils from a number of coals have been partially separated into compound types by desorption chromatography or HPLC, and the fractions have been analyzed by GC/MS. Petrographic examination of the residues from liquefaction shows that a number of phenomena related to the coking process take place during liquefaction, and their incidence varies with rank. (DMC)

11614 (DOE/ET/11430—T1) **Gasification of fuels in molten sodium phosphate. Final report.** Gavalas, G.R. (California Inst. of Tech., Pasadena (USA)). Dec 1981. Contract FG21-78ET11430. 154p. NTIS, PC A08/MF A01. Order Number DE83003361.

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This research project investigated the kinetics of steam and oxygen gasification of methane, petroleum coke and residual oil in molten sodium phosphate. The gasification of solid fuels such as petroleum coke in molten sodium phosphate is subject to two opposing effects: (i) the gasification rate is catalytically enhanced by the molten salt by a factor of two to five and (ii) at fixed gas flow rate, increasing the amount of suspended solid particle does not increase the total gasification rate beyond a certain saturation level. The saturation level is roughly proportional to the gas holdup and increases with the size of the solid particles. At gas holdups of about 0.1, saturation was established at a volume fraction of solids below 0.001. Since saturation of the rate is disadvantageous, as it limits the

reactor throughput, further research is required to quantitatively establish the effects of particle size, bubble size and gas holdup. Steam reforming of gaseous hydrocarbons in molten Na_2O-P_2O_5 occurs by first cracking to hydrogen and coke and subsequent steam reforming of the suspended coke. The overall rate is controlled by the steam reforming of coke which is subject to the fluid mechanical phenomenon of saturation. At low ratios, nickel exists as metal particles suspended in the melt, and the reaction of steam with the gaseous hydrocarbons takes place directly on the nickel particles and not via coke intermediate.The rate is much higher than in the absence of nickel. The steam reforming of residual oil takes place via the coke intermediate and is subject to the saturation limitation. The results suggest that steam reforming of residual oil in molten Na_2O-P_2O_5 would not be industrially attractive because of the slow gasification of the suspended coke formed from the cracking of oil.

11615 (DOE/ET/12103—T4) Development of new catalysts for coal liquids refining. Final report, January 1979-April 1981. Schwager, I. (Filtrol Corp., Los Angeles, CA (USA)). Jun 1981. Contract AC22-78ET12103. 190p. NTIS, PC A09/MF A01. Order Number DE82021084.

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Cracking, hydrocracking and hydrotreating catalysts were prepared and tested for activity on a 337 to 700°F SRC-II Fuel Oil Blend and hydrogenated products from this feed material. Sixty-five cracking catalysts were prepared and activity tested at two different temperatures (900 and 1000°F) on two different feeds (SRC-II Fuel Oil Blend: as is, 8.7 wt % hydrogen, and hydrogenated, 11.0 wt % hydrogen). With the hydrotreated SRC-II Fuel Oil Blend corrected conversions of 430°F+ feed of 68 to 75 wt %, C_5-EP gasoline product distribution of ~ 50 wt %, and coke makes of 4 to 9 wt % were obtained at 900°F with catalysts composed of broad pore volume distribution matrix binder components and active exchanged Y-zeolites. When the same catalysts were tested on the unhydrotreated SRC-II Fuel Oil Blend, conversion and gasoline in the product were much lower (37 to 39 wt %, and 18 to 20 wt %, respectively) and coke was (8 to 14 wt %). Thirty hydrocracking catalysts were prepared and activity tested on hydrotreated SRC-II Fuel Oil Blend. Three series of bi-functional catalysts containing low-sodium cracking bases such as hydrogen and rare earth exchanged ultrastable Y-zeolites (US-Y), and exchanged or metal substituted Synthetic Montmorillonite Micas (SMM's) containing Group VIB and/or Group VIII hydrogenating metal components were prepared and tested. One hundred hydrotreating catalysts were prepared and activity tested continuously under the same conditions used for hydrocracking activity testing. None of the exploratory catalysts tested were quite as good as the commercial Filtrol HPC-40 for HDN (85% maximum vs 88% for HPC-40). The HDS results were similar for the best exploratory and commercial catalysts (94 to 96%).

11616 (DOE/ET/14801—30) Gas/slurry flow in coal-liquefaction processes (fluid dynamics in a three-phase-flow column). Final technical progress report, 1 October 1979-31 March 1982. Ying, D.H.S.; Sivasubramanian, R.; Moujaes, S.F.; Givens, E.N. (Air Products and Chemicals, Inc., Allentown, PA (USA)). Apr 1982. Contract AC22-79ET14801. 365p. NTIS, PC A16/MF A01. Order Number DE83001643.

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A commercial coal liquefaction plant will employ vertical tubular reactors feeding slurry and gas concurrently upward through these vessels. In the SRC-I plant design the reactor is essentially an empty vessel with only a distributor plate located near the inlet. Because the commercial plant represents a considerable scale-up over Wilsonville or any pilot plant, this program addressed the need for additional data on behavior of three phase systems in large vessels. Parameters that were investigated in this program were studied at conditions that relate directly to projected plant operating conditions. The fluid dynamic behavior of the three-phase upflow system was studied by measuring gas and slurry holdup, liquid dispersion, solids suspension and solids accumulation. The dependent parameters are gas and liquid velocities, solid particle size, solids concentration, liquid viscosity, liquid surface tension and inlet distributor. Within the range of liquid superficial velocity from 0.0 to 0.5 ft/sec, gas holdup is found to be independent of liquid flow which agrees with other investigators. The results also confirm our previous finding that gas holdup is independent of column diameter when the column diameter is 5 inches or larger. The gas holdup depends strongly on gas flow rate; gas holdup increases with increasing gas velocity. The effect of solids particles on gas holdup depends on the gas flow rate. Increasing liquid viscosity and surface tension reduce gas holdup which agrees with other investigators. Because of the complexity of the system, we could not find a single correlation to best fit all the data. The degree of liquid backmixing markedly affects chemical changes occurring in the dissolver, such as sulfur removal, and oil and distillate formation.

11617 (DOE/ET/14803—T7) Coal-liquefaction catalyst development. Annual report No. 1, April 1, 1979-June 30, 1980. Mahoney, J.A.; Helstrom, J.J.; Pellet, R.J. (Amoco Oil Co., Naperville, IL (USA). Research and Development Dept.). Aug 1980. Contract AC22-79ET14803. 184p. NTIS, PC A09/MF A01. Order Number DE83004460.

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This report discusses the results of work aimed at developing new catalysts for the H-Coal liquefaction process. Catalytic baseline runs continued with HDS-1442A in order to improve our baseline statistics as well as to monitor batch reactor performance. Testing of several new catalyst formulations was completed. Promising candidates were found in the areas of stabilized aluminas and novel catalyst systems. These formulations will be tested in the continuous aging unit. A major portion of our effort this quarter was concerned with ascertaining the liquefaction behavior of a Western coal such as Wyodak with Amocat type catalysts. H-Coal continued to concentrate on the evaluation of the large 500 pound batch of Amocat-1A to be used in the HRI PDU tests. Final product analyses were completed and the large batch of Amocat-1A clearly exhibited improved performance over the H-Coal catalyst, HDS-1442A. This batch of Amocat-1A will be used in HRI's 3 T/D pilot plant run, PDU-10. Catalysts from four other DOE contractors were evaluated and found to have poorer initial liquefaction activity, deactivation rates and selectivity than Amocat 1A. Techniques to correlate catalyst activity in the HRI units and the Amoco continuous aging unit were investigated.

11618 (DOE/ET/14804—Q7) Integrated two-stage liquefaction. Topical technical progress report completion of Indiana V program, April 1, 1981-September 30, 1981. Schindler, H.D.; Chen, J.M.; Potts, J.D. (Lummus Co., Bloomfield, NJ (USA); Cities Service Research and Development Co., Tulsa, OK (USA). Cities Service Technical Center). Nov 1982. Contract AC22-79ET14804. 180p. NTIS, PC A09/MF A01. Order Number DE83005273.

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This program combines a research study on Catalytic Expanded Bed Hydroprocessing of Coal Extracts and the operation of an Integrated Two-Stage Liquefaction Process Development Unit. The integrated operation with Indiana V coal was completed with the conclusion of LC-Fining Run 3LCF7. The first of three 29-day diffusional study runs, PDU Run 4LCF-2, was completed on Shell 324 NiMo 1/32-inch extruded catalyst. The run was made in a new LC-Fining PDU that has three reactors in series and is capable of providing interstage samples between the reactors. Some catalyst deactivation for conversion was detected, but no decline was observed for denitrogenation. Both percent conversion and percent denitrogenation increased with decreasing 850°F+ concentration in the feed. LC-Fining Run 3LCF-7 was completed with a final catalyst life of 1070 pounds of 850°F+ feed per pound of catalyst. Conversion activity held constant for the entire run while denitrogenation activity declined. The increase of nitrogen in the product was found to be principally in the unconverted 850°F+. Approximately 70% of the SCT paste solvent consisted of LC-Fining heavy oil product, including unconverted 850°F+. This solvent continued to provide almost all the hydrogen for liquefaction of the Indiana V coal. The hydrogen-transfer capacity of the solvent was unaffected by LC-Fining catalyst age. Hydrogen consumption and C_1-C_4 yields increased with SCT residence time, while 850°F+ yields decreased with 850°F+ concentration in the recycle solvent. The in-

tegrated PDU is being prepared for a program on Illinois No. 6 coal.

11619 **(DOE/ET/14880—T2) Kinetics and mechanism of catalytic hydroprocessing of components of coal-derived liquids. Thirteenth quarterly report, May 16-August 15, 1982.** Gates, B.C.; Kwart, H.; Olson, J.H.; Schuit, G.C.A.; Stiles, A.B.; Petrakis, L. (Delaware Univ., Newark (USA). Dept. of Chemical Engineering; Gulf Research and Development Co., Pittsburgh, PA (USA)). 23 Oct 1982. Contract AC22-79ET14880. 43p. NTIS, PC A03/MF A01. Order Number DE83003637.

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Attention was focused on the following areas: (1) solubilities of the fractions obtained from SRC-II heavy distillate in various solvents, (2) gas chromatographic characterizations of the fractions, and (3) chemical ionization (CI) and electron impact (EI) high-resolution capillary GC mass spectrometry of the fractions. A large number of solvents were tested, including n-hexadecane, cyclohexane, toluene, methylene chloride, and chloroform. All fractions, except for A1 and B2, dissolved in cyclohexane to a sufficient extent. A 50-50 wt % mixture of methylene chloride and chloroform was the best solvent tested for all the fractions. Gas chromatographic characterization of all the fractions was done to determine: (1) the whole set of compounds (FID trace), (2) the sulfur-containing compounds (Hall detector - sulfur mode), and 3) the nitrogen-containing compounds (Hall detector - nitrogen mode). CI and EI GC/MS data were obtained for the neutral oils fraction, a simulated neutral oils fraction, the three basic fractions, and the neutral nitrogen compounds (neutral resins) fraction. The GC/MS with capillary columns and the sulfur- and nitrogen-specific detectors is a powerful analytical technique for the coal-liquid fractions; the details of the analyses, provided here, are expected to be of use to many researchers interested in synthetic liquids.

11620 **(DOE/FE/05147—T11) Coal-gasification basic research and costs studies. Quarterly report No. 4.** (McKee (Davy) Corp., Cleveland, OH (USA)). 15 Oct 1982. Contract AC21-81FE05147. 50p. NTIS, PC A03/MF A01. Order Number DE83003064.

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Work was continued on basic research and cost studies supporting the Department of Energy's coal gasification program. Two major activities or tasks are being performed. The first activity is the development of a process or processes to produce agglomerates from coal fines suitable for use as a feed to fixed-bed gasifiers. During the Fourth Quarter approximately 70 double-roll briquetting runs and 97 pelletizing runs were performed to evaluate promising binder candidates and to investigate other briquetting and pelletizing variables. All agglomerates were tested for room temperature handling ease (measured by crush-strength and drop-shatter tests) and for stability and performance at gasifier temperatures. The best agglomerates were further evaluated in a modified Burghardt test and in a tumbler test. Ten agglomerate compositions, eight briquettes and two pellets, were run in a small gasifier at American Natural Resources. Most agglomerates performed well in this gasifier. In Task II, the design of a gasification plant with Rockwell Molten Salt gasifiers was completed, and estimates of capital and operating costs were developed. Work on all basic cases has now been completed and only the incorporation of a briquetting facility into the fixed-bed plant design remains to be done.

11621 **(DOE/FE/15066—1199) Conceptual integrated gasifier combined-cycle power-plant design. Final report.** (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). 1982. Contract AC21-81FE15066. 366p. NTIS, PC A16/MF A01. Order Number DE83003020.

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This final report describes the results of a study for the US Department of Energy to prepare a Conceptual Design of an Integrated Gasifier Combined Cycle (IGCC) Power Plant. The study was conducted by a team of organizations to provide the necessary information for the diverse systems which make up an IGCC plant. The operating characteristics, reliability and cost estimates for the fuel preparation train, including the Texaco gasifier, were prepared by Bechtel Group, Inc. Similar information for the gas turbine system was provided by United Technologies Corporation. System optimization and steam system characteristics were developed jointly. The overall power plant designs were prepared by Bechtel. Niagara Mohawk Power Corporation provided utility view points and consultation as well as a specific site location. United Technologies managed the contract. Conceptual designs were prepared for a grass roots plant and repower configuration. A demonstrator plant for verification of concepts was configured, including a development plan and associated costs.

11622 **(DOE/LC/10705—T1) Overburden characterization and post-burn study of the Hoe Creek, Wyoming underground coal gasification site and comparison with the Hanna, Wyoming site.** Ethridge, F.C.; Burns, L.K.; Alexander, W.G.; Craig, G.N. II; Youngberg, A.D. (Colorado State Univ., Fort Collins (USA); Department of Energy, Laramie, WY (USA). Laramie Energy Technology Center). Jan 1983. Contract AS20-81LC10705. 194p. NTIS, PC A09/MF A01. Order Number DE83005075.

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In 1978 the third test (Hoe Creek III) in a series of underground coal gasification (UCG) experiments was completed at a site south of Gillette, Wyoming. The post-burn study of the geology of the overburden and interlayered rock of the two coal seams affected by the experiment is based on the study of fifteen cores. The primary purpose of the study was to characterize the geology of the overburden and interlayered rock and to determine and evaluate the mineralogical and textural changes that were imposed by the experiment. Within the burn cavity the various sedimentary units have been brecciated and thermally altered to form several pyrometamorphic rock types of paralava rock, paralava breccia, buchite, buchite breccia and hornfels. High temperature minerals of mullite, cordierite, oligo-clase-andesine, tridymite, cristobalite, clinopyroxenes, and magnetite are common in the pyrometamorphic rocks. The habit of these minerals indicates that they crystallized from a melt. These minerals and textures suggest that the rocks were formed at temperatures between 1200° and 1400°C. A comparison of geologic and geological-technological factors between the Hoe Creek III site, which experienced substantial roof collapse, and the Hanna II site, which had only moderate roof collapse, indicates that overburden thickness relative to coal seam thickness, degree of induration of overburden rock, injection-production well spacing, and ultimate cavity size are important controls of roof collapse in the structural setting of the two sites.

11623 **(DOE/LC/RI—83-1) Depositional environments, subsurface stratigraphy, and post-burn characterization of the Paleocene-Eocene Hanna formation at the Hanna, Wyo UCG site: Hanna III experiment.** Youngberg, A.D.; McClurg, J.E.; Schmitt, J.G. (Department of Energy, Laramie, WY (USA). Laramie Energy Technology Center). Jan 1983. 125p. NTIS (US Sales Only). Order Number DE83005076.

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During the summer of 1981 the Laramie Energy Technology Center conducted a post-burn coring program at the Hanna III Underground Coal Gasification site, Hanna, Wyoming. Detailed geologic studies were conducted on the altered and unaltered overburden as well as an analysis of the burn cavity. The overburden consists of about 46m of Paleocene-Eocene Hanna formation above the Hanna No. 1 coal seam used in the burn. The overburden contains two basic lithologic units: Unit A consists of very fine-grained sandstones, siltstones, and claystones deposited as a lacustrine delta. Unit A is immediately above the Hanna No. 1 coal. Unit B is above Unit A and consists of carbonaceous shales and mudstones containing isolated lenticular and tabular sandstone bodies deposited in a meandering fluvial system. The Hanna No. 1 coal accumulated in a poorly drained swamp that was subject to clastic flooding from an adjacent fluvial system. A reactor cavity 26m x 16m x 15m was formed during the burn and partially filled with rubble and three types of pyrometamorphic rock: paralava, paralava breccia, and buchite. The lithology, thickness, and lateral continuity of Unit A had a definite influence on the success of the experiment as the growth

of the reactor cavity was contained completely within the lithologic unit.

11624 (DOE/MC/14273—1318) Vibration monitoring of ebullating pump at the H-Coal pilot plant. (Mechanical Technology, Inc., Latham, NY (USA). Research and Development Div.). Dec 1982. Contract AC21-80MC14273. 247p. NTIS (US Sales Only). Order Number DE83005059.

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Mechanical Technology Incorporated (MTI), under contract to the Department of Energy, has been monitoring the performance of the reactor-ebullating pump at the H-Coal pilot plant using vibration measurement techniques. During the progress of this project, some unique pump dynamic characteristics, which are not common to rotating equipment, have been found. Specifically, the vibration measurements contained very small signals at frequencies of once-per-revolution (1/rev) and its harmonics which are related to the pump speed. The predominating signals are structural type of resonances. To enhance the vibration data interpretation and to provide better guidelines in establishing the pump monitoring scheme, analytical analysis of the pump rotor-bearing-piping system has been performed. This report presents the findings of the anlaysis. The analysis utilized the state-of-the-art methodologies in the fields of structural dynamics and rotor-bearing system dynamics. It also included a unique approach in coupling the calculations of these two fields. Results of the anlaysis provided better interpretations of the existing vibration data. It also shed light on the generic characteristics of the pump system. Significant conclusions of the anlaysis are summarized.

11625 (DOE/MC/14705—3) Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981. (Institute of Gas Technology, Chicago, IL (USA)). Oct 1982. Contract AC21-80MC14705. 109p. NTIS, PC A06/MF A01. Order Number DE83005214.

This report presents work on support research programs in aid of coal gasification: effects of process variables, entrainment studies in fluidized bed reactors (effect of pressure, velocity, and particle size), high temperature characteristics of fluidized chars (sintering and effect of oxygen concentration), void-gas stripping (e.g. of oxygen to avoid hazards), catalytic upgrading of raw fuel gas, phase equilibrium of gases in fuel gas and water, fuel gas desulfurization and catalytic decomposition of ammonia and catalytic hydrolysis of COS and HCN, improved methods of waste treatment (ultra- and micro-filtration, reverse osmosis, membrane testing, etc.). (LTN)

11626 (DOE/MC/16022—1307) Studies on the regeneration of sulfided iron oxide sorbent with steam-air mixtures. Final technical report. Tamhankar, S.S. (West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering). Oct 1982. Contract AT21-81MC16022. 42p. NTIS, PC A03/MF A01. Order Number DE83004031.

The work reported here was performed as a continuation of studies conducted previously at West Virginia University (WVU), Department of Chemical Engineering on a hot-fuel-gas desulfurization process using a regenerable iron oxide-silica sorbent. The overall process consists of two stages: the absorption or the H_2S removal stage and the sorbent regeneration stage. In the absorption stage the iron oxide reacts with H_2S to form iron sulfide. For regeneration of the sulfided sorbent, various schemes have been proposed. Studies at WVU have been aimed at identifying the important reactions involved in absorption and regeneration stages, elucidating their mechanisms and investigating detailed kinetics. In the first two phases of the study, reactions in H_2S absorption and in sorbent regeneration by air/SO_2 were investigated. This report addresses regeneration of the sulfided sorbent using steam-air mixtures. Experiments were conducted in a thermo-gravimetric analyzer (TGA) apparatus. The weight changes were recorded as a function of time during the reactions of iron sulfide (in the presulfided sorbent) with nitrogen-stream and air-steam mixtures. In addition, several solid samples at different conversion levels were anlayzed by LECO sulfur anlaysis technique and by Mossbauer spectroscopy. Based on these results, a reaction mechanism has been postulated. Additional work is necessary to investigate the gas-phase reactions which may be taking place simultaneously in a fixed - or a fluidized-bed reactor, and to formulate the overall reaction scheme. 14 figures, 3 tables.

11627 (DOE/MC/16024—T4) Gas characterization from fluidized-bed coal gasification. Fourth quarterly report, June 1-August 31, 1982. Ciliberti, D.F.; Smeltzer, E.E.; Rohatgi, N.T.; Alvin, M.A.; Keairns, D.L.; Turner, A.B.; Lagonik, F.; Lojek, D. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 1982. Contract AC21-81MC16024. 37p. NTIS, PC A03/MF A01. Order Number DE83004519.

The Westinghouse Electric Corporation is characterizing the nature of alkali, trace metal, particulate, and hydrocarbon emissions in the hot fuel gas stream produced in the Westinghouse fluidized bed gasifier. This program is being carried out to determine the potential environmental and process implications of these emissions. Data reduction from measurements on the samples taken during the May test (TP-032-2) was completed. Samples were taken from two of the set points during the August test (TP-033-1) and were submitted for analysis. Alkali modeling systems analysis has begun on the data generated from the May test (TP-032-2). Utilizing the reported coal composition and PDU test parameters, a preliminary review of the alkali reactions and possible transformations during gasification was initiated. The equilibrium estimates project volatilization of 1.26% of the feedstock sodium, and 0.35% of the feedstock potassium, representing 1.99 ppM NaCl and 1.03 ppM KCl as the principal volatile alkali species. These volatile phases are projected to exist in equilibrium with solid $NaAlSi_3O_8$ and $KAlSi_3O_8$ present in the ash. The estimates, which should be viewed only as a preliminary projection since a chlorine concentration of 0.01 wt % was assumed and had not been analytically defined, do indicate the relatively low concentration of volatile alkali which can be expected to be released from the coal matrix at the gasifier outlet.

11628 (DOE/PC/30080—8) Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Final progress report, February 1980-July 1982. Cronauer, D.C.; McNeil, R.I.; Young, D.C.; Ruberto, R.G. (Gulf Research and Development Co., Pittsburgh, PA (USA)). Sep 1982. Contract AC22-80PC30080. 222p. NTIS, PC A10/MF A01. Order Number DE83004849.

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The objective of this program was to increase the understanding of the mechanism of hydrogen transfer during coal liquefaction. This included determining the role of the donor solvent, the rate of hydrogen transfer, site of hydrogen transfer, preferred types of solvent, and the fate of the solvent including adduction and isomerization. Hydrogen can be transferred among hydroaromatic species, heavy aromatic species (for example, pyrene), and the gas by means of an exchange mechanism. This exchange strongly affects the distribution of deuterium (when used in labeled donors) in various product fractions from coal liquefaction runs. Extensive levels of scrambling of deuterium from a labeled solvent to coal-derived products are observed. A sizable portion of the coal liquefaction solvents is lost through adduction (either chemical attachment or hydrogen bonding) with coal-derived products. Even good hydrogen donors such as tetralin are adducted readily. Isomerization of hydroaromatic species in the solvent to methyl indan-type compounds (of lower hydrogen donor quality) also plays a significant role in liquefaction processes using recycle solvents. Multiple ring hydroaromatic species have been shown to be effective coal liquefaction solvents considering their ability to penetrate coal and readily transfer hydrogen. Multiple ring aromatic species also readily shuttle hydrogen as demonstrated by deuterium-labeling experiments.The kinetics of coal liquefaction at short residence times have also been studied. Initially there is an effective loss of solvent (oil fraction), whereas the preasphaltenes and asphaltenes are rapidly formed indicating a fast dissolution of coal in the initial stages.

11629 **(DOE/PC/40009—T1) Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.1.** Mahoney, J.A.; Schwartz, M.M.; Wittrig, T.S. (Amoco Research Center, Naperville, IL (USA)). Feb 1982. Contract AC22-81PC40009. 17p. NTIS, PC A02/MF A01. Order Number DE83004595.

The objective of this program is to identify advanced coal-liquefaction catalysts and operating conditions for use in optimized, two-stage, direct coal-liquefaction-process applications and to experimentally test catalysts in a two-stage reaction system for supporting the improvement of this process. Further improvements in direct-liquefaction technology will rely on a program plan aimed at developing two-stage processes. Use of Amocat bimodal catalysts will permit solid separation after the second stage where good-quality, low-viscosity coal-liquid product eases solid-liquid separation problems. Optimization of two-stage process conditions as well as second-stage catalysts will permit substantial improvement of direct-coal-liquefaction technology. Conditions and catalysts will be optimized to permit maximum production of donor-solvent boiling-point material, low in sulfur, nitrogen, and oxygen content. A development plan consisting of eight project tasks has been formulated and is summarized as follows: Project Work Plan, Literature Survey, Feed Materials Specification, Continuous Aging Unit Modification, Thermal Reaction Process Variable Study, Two-Stage Optimization, Project Coordination, and Ebullated Bed Testing.

11630 **(DOE/PC/40009—T2) Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.2.** Mahoney, J.A.; Schwartz, M.M.; Wittrig, T.S. (Amoco Research Center, Naperville, IL (USA)). May 1982. Contract AC22-81PC40009. 38p. NTIS, PC A03/MF A01. Order Number DE83004596.

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An analysis of literature and patents dealing with coal liquefaction, coal liquid upgrading, and related hydroprocessing technology has highlighted possible leads for the development of an advanced, integrated two-stage coal liquefaction process. This report discusses publications that have appeared in the literature since 1975 when Amoco issued a similar report in the area of direct, catalytic, coal liquefaction technology. One of the major conclusions to emerge in the literature of the past few years is that coal liquefaction is fundamentally a two-step process. The first step is a thermal depolymerization of the coal matrix to form large preasphaltene molecules. Many of these large molecules are free radicals which must be stabilized by hydrogen donors if they are not to repolymerize. This reaction takes place comparatively rapidly and is facilitated by high temperatures. In general, the addition of catalysts does not affect the rate or the course of this depolymerization. In the second, slower phase of liquefaction, the slurry reacts further with the hydrogen donor solvent present in the reactor. The preasphaltenes crack to smaller molecules, the heteroatoms are removed to some extent and the free radicals formed during depolymerization either repolymerize with other free radicals or are capped with hydrogen. It is during this step that catalyst function becomes important for heteroatom removal, hydrocracking of the coal molecules and hydrogenation of the solvent and the product. The high temperatures required in the first stage are fundamentally incompatible with the second stage for two reasons. The catalysts are poisoned more rapidly by coking at high temperatures and high temperatures encourage the formation of light products which unprofitably consume expensive hydrogen.

11631 **(DOE/PC/40009—T3) Advanced coal-liquefaction-catalyst development. Quarterly progress report, No. 3.** Mahoney, J.A.; Schwartz, M.M.; Wittrig, T.S. (Amoco Research Center, Naperville, IL (USA)). Aug 1982. Contract AC22-81PC40009. 20p. NTIS, PC A02/MF A01. Order Number DE83004526.

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The modification of the continuous coal liquefaction pilot plant from a single reactor to a two-stage unit is proceeding as planned. The major vessels and the area around the unit have been thoroughly cleaned. Most of the piping has been removed and is currently being replaced. The control elements have been recalibrated and are ready to be put back on the unit. The modification is scheduled to be completed in September. A microautoclave coal liquefaction test has been developed to permit rapid evaluation of different solvents, catalysts, and process configurations. It has been used to evaluate heavy creosote oil before and after hydroprocessing. Preliminary experiments were conducted to determine if the test could distinguish between a poor donor solvent (Panasol) and a good donor solvent (tetralin) in the liquefaction of Illinois No. 6 coal using either a toluene or THF work-up and to establish the repeatability of the data. These data are shown in Table 7-1.

11632 **(DOE/PC/40799—T4) Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, July 1, 1982-September 30, 1982.** Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Dec 1982. Contract FG22-81PC40799. 10p. NTIS, PC A02/MF A01. Order Number DE83004577.

It is interesting to note that the eluted samples from the microbore column are easily detected by FTIR as can be seen by the reasonable signal-to-noise ratio of the file spectra. The solvent consumption is particularly appealing, being less than 1.0 mL total volume per chromatogram. This corresponds to a ten-fold decrease in solvent consumption over the analytical scale, and nearly a fifty-fold decrease over the semi-preparative scale. The actual time of the separation is virtually the same in all cases if column length is considered. HPLC-FTIR can be a valuable tool in complex mixture analysis. Limitations on solvent windows can be partially overcome by decreasing the cell pathlength if the component concentrations can be increased. This study has shown the feasibility of microbore HPLC-FTIR as a routine tool, which allows the chromatographer to use solvents with large infrared windows which were previously not considered because of their high cost. As the state-of-the-art of microbore column technology increases, the better separations that are expected will be readily amenable to FTIR detection. Better detection limits should be obtainable with longer pathlength/lower volume cells as well as employment of more sensitive FTIR detectors which are generally employed in GC-FTIR.

11633 **(DOE/PC/40800—T2) Supercritical fluids for extraction and reaction of coal and heavy oils. First quarterly progress report, September 1, 1982-December 1, 1982.** Holder, G.D.; Gopal, J.S.; Deshpande, G.V. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Dec 1982. Contract FG22-81PC40800. 43p. NTIS, PC A03/MF A01. Order Number DE83005235.

Experiments have been conducted with glucose and German brown coal using water as the supercritical phase. (Glucose is used as a model compound to verify the results obtained by other investigators). The experiments were conducted in two different modes. In one case, the coal (or glucose) was injected into the reactor which contained water already at a supercritical temperature. In the other, the coal was charged into the reactor with water and the mixture was subsequently heated to supercritical temperatures. For those experiments where the density of the supercritical water was close to its critical density and where the water was preheated prior to the injection of coal, only 25 to 30% THF insolubles were obtained. In experiments where lower densities (at the same temperature) were used, the THF insolubles increased to around 60%. Similar results have been reported in the low density region in the literature. It appears that it is very important to have the water phase at its critical density prior to coal injection. In the experiments where coal or glucose was mixed with the water prior to heating to supercritical temperatures, a significant amount of char was obtained and THF insolubles for the coals was around 42%. In one experiment with glucose present during the heatup period, nearly 10% char was obtained even though densities close to the critical density of water were used. The amount of char increased to nearly 40% when the density was low (0.07 g/cc as compared to a critical density of 0.31 g/cc for water). Normally, no char would be expected when preheated water and cold glucose are mixed at supercritical conditions. The experimental set-up for model compound solubility determinations has been completed and preliminary runs on a binary system have shown satisfactory operation. Two appendices have been entered individually.

11634 (DOE/PC/40800—T2, pp 16p, App. I) **Use of supercritical water for extraction of low rank coals.** Deshpande, G.V.; Holder, G.D.; Bishop, A.A.; Gopal, J.S.; Wender, I. (Univ. of Pittsburgh, PA). Dec 1982. NTIS, PC A03/MF A01. Contract FG22-81PC40800.

In Supercritical fluids for extraction and reaction of coal and heavy oils. First quarterly progress report, September 1, 1982-December 1, 1982.

An experimental apparatus is developed for the injection of low rank coals into an autoclave containing preheated supercritical water. The supercritical water appears to act as both a solvent and reactant in the conversion of low rank coals to gases and liquids. Experiments were done with German brown coal and glucose at both subcritical and supercritical densities. A significant amount of char was obtained when operating at subcritical densities. More char was obtained when the coal was heated with water to supercritical conditions. The results obtained are preliminary, but they do provide some insight. The conversion of low rank coals to liquids by injecting coal into supercritical water is dramatically higher than the amount of liquids obtained when the coal is added to ambient water with subsequent heating of the slurry. This is an appealing result since no added hydrogen is required. We are doing further studies at higher densities to ascertain what the upper limit on yields is. We will also investigate higher rank coals and do a more thorough liquids analysis in future runs.

11635 (DOE/PC/40800—T2, pp 19p, App. II) **Supercritical behavior in multicomponent system.** Gopal, J.S.; Holder, G.D. (Univ. of Pittsburgh, PA). Dec 1982. NTIS, PC A03/MF A01. Contract FG22-81PC40800.

In Supercritical fluids for extraction and reaction of coal and heavy oils. First quarterly progress report, September 1, 1982-December 1, 1982.

The behavior of solubility of relatively non-volatile solids in supercritical fluids has been investigated. Two models have been proposed to predict the solubility of solids in multicomponent systems from a thermodynamic viewpoint. The models include parameters which are obtained from binary solubility data. Experiments have been conducted with mixtures of solids to study their behavior under supercritical conditions.

11636 **(DOE/PC/40801—T5) Solvent and chemical-reaction effects in supercritical extraction of coal. Fifth quarterly technical progress report, September 1-November 30, 1982.** Vasilakos, N.P. (Texas Univ., Austin (USA). Dept. of Chemical Engineering). 1982. Contract FG22-81PC40801. 11p. NTIS, PC A02/MF A01. Order Number DE83003923.

During the fifth quarter of the project our research efforts have concentrated on the physical and chemical analyses of the treated coal samples that were obtained during the fourth quarter in extraction experiments with a series of supercritical solvents and solvent mixtures. We have also studied the effect of temperature on supercritical extraction, and we are currently completing the last phase of our investigation on polar effects and their significance in determining the yield and quality of supercritical extraction products. A detailed discussion of our results is presented.

11637 **(DOE/PC/40812—T5) New catalysts for coal-liquid upgrading. Quarterly report, September 1-December 31, 1982.** Boucher, L.J. (Western Kentucky Univ., Bowling Green (USA). Dept. of Chemistry). 1982. Contract FG22-81PC40812. 12p. NTIS, PC A02/MF A01. Order Number DE83004313.

Several silica supported metal catalysts were prepared by impregnating cab-o-sil (HS-5) with an aqueous solution of $M(NO_3)_2 \cdot 6H_2O$ where M is Co, Cu, Ni and Mg. Other new wilica supported copper phthalocyanine catalysts were also prepared. The activity of two cobalt Phthalocyamines is compared to that of cobalt metal at several temperatures in Table 2. It is seen that the activity of [Co(PC)] more closely approaches that of the metal as the temperature increases. One explanation for this is that the complex decomposes to a greater extent at higher temperature and that the most activity catalyst in the system is the metal. Further, the data in Table 3 can be interpreted from the point of view that, as expected, the [Cu(PC)] is more stable at higher temperature. A mixture of substrates that model those compounds typically found in coal liquids was prepared. Although the activity increases with temperature, even at the highest temperature the only reaction noted is the hydrogenation of quinoline. No hydrogenalysis is noted, nor is there any hydrogenation of the other possible substrates in the mixture. Finally the [Co(PC)] is more active than $[Cu(PC)]/SiO_2$. The activity of [Co(PC)] is greater for quinoline hydrogenation in the model mixture than in decane alone. This synergistic effect is also seen for quinoline with individual members of the mixture. The catalysts $[Co(PC)]/SiO_2$ and $[Sn(PC)Cl_2]/SiO_2$ are not active in the hydrogenation of pyrrole, pyridine and isoquinoline in the range 250 to 350°C. However, activity is observed for multiring substrates. Thus, indole and carbozole are scarcely hydrogenated while quinoline, acridine and quinaldine are substantially hydrogenated.

11638 **(DOE/PC/41030—T1) Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982.** Bishop, A.A.; Deshpande, S.D. (Pittsburgh Univ., PA (USA)). Nov 1982. Contract AC22-81PC41030. 185p. NTIS, PC A09/MF A01. Order Number DE83003625.

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A thermal-hydraulic analysis of two-phase non-Newtonian slurry-gas flow existing in coal liquefaction preheaters has been done. A new model for the prediction of pressure drop for preheaters has been developed based on the analysis of pressure drop data obtained from various pilot plants. A similar work for the heat transfer models has been initiated.

11639 **(DOE/PC/41760—T2) Structural characteristics of cobalt particles in a 9.5%Co-ZSM-5 catalyst. Semiannual report, May 18, 1982-November 18, 1982.** De Angelis, R.J. (Kentucky Univ., Lexington (USA)). 1982. Contract AC22-81PC41760. 15p. NTIS, PC A02/MF A01. Order Number DE83002808.

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A detailed structural study of cobalt particles in a 9.5%Co-ZSM-5 catalyst was made using x-ray diffraction and analytical transmission electron microscopy. The results obtained from these two techniques show the cobalt particles contain a high concentration of basal plane stacking faults. On the average one out of every twelve basal planes is faulted. It is suggested that atoms of a particle which lie at positions on the surface where intersection stacking faults exist may be the origin of active sites.

11640 **(DOE/PC/42682—T4) Field-simulation analysis for disposal of liquefaction solid waste. Final report.** (Enviro Control, Inc., Rockville, MD (USA)). Dec 1982. Contract AC22-81PC42682. 338p. NTIS, PC A15/MF A01. Order Number DE83004817.

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The Department of Energy's Office of Fossil Energy has as one of its major concerns the responsibility of ensuring that research and development concerning environmental issues are conducted in parallel with the ongoing R and d program in coal technology. DOE's Pittsburgh Energy Technology Center (PETC) has the mandate to take a lead role in the development of coal liquefaction technology. As part of fulfilling its responsibility, PETC funds research to evaluate multimedia (air, water, land) pollutant transport and fate. Since coal-related energy technologies generate large amounts of wastes requiring disposal, PETC is concerned with determining that the technology exists for disposing of these wastes safely prior to commercialization of coal liquefaction processes. This research project involves designing a program to determine whether the disposal of wastes from coal liquefaction is likely to represent a hazard. The passage of the Resource Conservation and Recovery Act (RCRA) in 1976 and subsequent regulations under this Act have greatly affected how the power industry is allowed to dispose of its wastes. RCRA is also concerned with ensuring that hazardous wastes are handled and contained in an acceptable manner. The various provisions of this Act have been reviewed and are taken into account as part of the monitoring program design proposed in this study. The work performed under this contract has led to the identification of a field simulation model system for coal liquefaction solid waste disposal sites and the requirements for the

models as well as to the design of a monitoring program to obtain the required input data for both model radiation and operation.

11641 **(DOE/PC/50041—11) Wilsonville Advanced Coal-Liquefaction Research and Development Facility, Wilsonville, Alabama: Run 240 with Illinois 6 coal. Technical progress report.** (Catalytic, Inc., Wilsonville, AL (USA)). Dec 1982. Contract AC22-82PC50041. 88p. NTIS, PC A05/MF A01. Order Number DE83004847.

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This report presents the operating results for Run 240 at the Advanced Coal Liquefaction R and D Facility in Wilsonville, Alabama. This run was made in a non-integrated two stage iquefaction (NTSL) mode using Illinois 6 coal from the Burning Star mine. Run 240 began on 31 May and continued through 20 July 1982. During this period, coal was fed continuously for 1203 hours. Three overall special product workup periods were selected and are analyzed herein. Six additional material balances around the hydrotreater unit are also reported. This run was made in support of the demonstration plant design effort by the International Coal Refining Company to define a yield structure and the exothermic heat of reaction for the SRC reactor when liquefying Illinois 6 coal.

11642 **(DOE/PC/50254—T1) Investigation of vaporization and devolatilization of coal/water mixtures. Second quarterly report, July 20, 1982-October 19, 1982.** Solomon, P.R.; Hamblen, D.G. (Advanced Fuel Research, Inc., East Hartford, CT (USA)). 20 Nov 1982. Contract AC22-82PC50254. 88p. NTIS, PC A05/MF A01. Order Number DE83004262.

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The objective of this program is to develop the capabilities to predict the vaporization and devolatilization behavior of coal/water mixtures under conditions appropriate for spray combustion. In investigating the behavior of coal/water slurries, particular attention will be paid to the conditions which affect the physical properties of the char such as reactivity, swelling and ash distributions. These are the key properties for evaluating the combustion of slurries in burners designed for oil. During the second quarter, pyrolysis experiments were repeated on the wet Beulah lignite after reactor modification to eliminate a problem with the water measurement. The repeated data compare favorably with the initial set. The same coal was pyrolyzed in the presence of oxygen to determine the effect of this variable. A Pittsburgh Seam coal was also injected with varying oxygen concentration. The char is being examined to determine the effect of the oxygen on the swelling properties. The conditions which control swelling are being investigated experimentally and theoretically. A discussion of the theory of swelling is presented with some sample computer simulations illustrating the effect of heating rate on swelling behavior. Photomicrographs of a Pittsburgh Seam coal pyrolyzed at different positions in the reactor, which resulted in different swelling behavior are presented and compared with the theory. Excellent agreement was obtained assuming a reasonable value of viscosity. Initial work on ignition is also underway. Oxidation experiments are being performed in the reactor and the literature is being reviewed in preparation for developing an ignition code. An interesting feature of this work is the influence of swelling and graphitization on the char reactivity.

11643 **(DOE/PC/50783—1) Heavy recycle-solvent studies in two-stage coal liquefaction. Second technical progress report, October 1-December 10, 1982.** Longanbach, J.R. (Battelle Columbus Labs., OH (USA)). 31 Dec 1982. Contract FG22-82PC50783. 12p. NTIS, PC A02/MF A01. Order Number DE83004970.

During the past few years, it has become widely recognized that there is exceptional solvent value for the direct liquefaction of coal in the 800$^+$ F material produced in the process. Solvent molecules can undergo at least three reactions during coal dissolution. Each of these reactions can be done particularly well by the larger molecules present in the heaviest part of the solvent. First, the solvent cycles between a hydroaromatic state and an aromatic state. During the hydroaromatic to aromatic conversion, solvent loses hydrogen, tranferring it to the coal to stabilize reactive coal fragments. Large aromatic systems require less energy to disrupt the aromtic system to add a molecule of hydrogen to produce a hydroaromatic and the large, partially hydrogenated aromatic systems which are formed are able to dehydrogenate readily. Second, the solvent acts as a physical solvent. Following the rule, like dissolves like, the largest solvent molecules are most like the coal molecules and are best able to stabilize them in solution. Finally, the solvent molecules contain heteroatoms which can form hydrogen bonds with the coal molecules and thus disrupt the hydrogen bond system of the coal, helping the coal to dissolve. The largest solvent molecules contain more heteroatoms, particularly nitrogen, and the larger aromatic ring systems make the heteroatom electrons more available for hydrogen bond formation. Some of the large molecules may perform more than one solvent function. Recycling the solvent around a loop consisting of coal dissolution, separation and hydrogenation results in an equilibrium composition of recycle solvent.

11644 **(DOE/PC/50798—1) Catalyzed gasification of coal: isotope and XPS studies.** Falconer, J.L. (Colorado Univ., Boulder (USA). Dept. of Chemical Engineering). Dec 1982. Contract FG22-82PC50798. 5p. NTIS, PC A02/MF A01. Order Number DE83004712.

This research aims to elucidate the reaction mechanism for the catalytic gasification of coal by metal carbonates, by identifying the reaction pathways and the active form of the catalyst. The insight into the mechanism will help in improving process kinetics of coal gasification. Alkali carbonates and alkaline earth carbonates are being used to catalyze the carbon dioxide-carbon gasification reaction. Temperature-programmed reaction, isotopic labeling of the carbon and oxygen atoms in the carbonate and mass spectrometric detection of labeled products are used to identify reaction pathways. X-ray photoelectron spectroscopy (XPS) analysis of carbon-carbonate mixtures is used, at reaction conditions, to determine the chemical state of the carbonate.

11645 **(DOE/PC/50816—1) Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 15 Dec 1982. Contract FG22-82PC50816. 30p. NTIS, PC A03/MF A01. Order Number DE83004618.

During the first quarter two iron-boride catalysts were prepared by chemical reduction of iron nitrate in $NaBH_4$ solution. A special filter was designed to expedite washing treatments following the chemical reduction. Samples of unsupported cobalt boride were reduced and tested for H_2 adsorption uptakes. A slow heating ramp (1 to 2°C/min) and a low reduction temperature (250°C) resulted in higher metal surface area relative to previous work. Since H_2 adsorption on Co-B catalysts is highly activated, a new procedure was developed for obtaining monolayer coverage. Moessbauer spectra, obtained for iron-boride catalysts at various stages of washing, provided evidence that washing with water (rather than methanol) causes undesirable oxidation of the catalyst. Two Moessbauer cells, one for low temperature and one for room temperature runs, were designed and fabricated. 10 figures, 3 tables.

11646 **(DOE/PC/53030—T1) H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report.** Goodwin, J.G. Jr.; Irwin, K.J. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 20 Nov 1982. Contract AC22-82PC53030. 183p. NTIS, PC A09/MF A01. Order Number DE83003045.

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Selective gas chemisorption has been performed with hydrogen and carbon monoxide as adsorbates on several iron and ruthenium zeolite-supported catalysts by static volumetric measurement. Adsorption measurements were taken at ambient conditions with the resulting isotherms indicating the presence of two types of adsorption; reversible and irreversible. Three different evacuation times were employed where applicable in order to evaluate the effect of this variable on the fraction of reversible adsorption. Several variables have been studied for three ZSM-5 supported and six H-Mordenite supported iron catalysts. Of the three ZSM-5 supported samples, two were prepared by a newly developed extraction technique with cyclohexane as the solvent whereas the other was prepared by incipient wetness. Both techniques appear capable of preparing catalysts of comparable average particle sizes although

pretreatment such as calcination before reduction may be an important factor. The H-Mordenite supported samples were prepared by the extraction technique with either cyclohexane or tetrahydrofuran (THF) as the solvent. The samples prepared with cyclohexane consistently yielded catalysts with smaller average particle sizes than those prepared with THF. Three ZSM-5 supported ruthenium samples were also prepared by the extraction technique with cyclohexane. Average particle sizes were found to be slightly affected by the metal loading as they ranged from 2.5 to 5.0 nm for metal loadings increasing from 1% to 8% ruthenium. X-ray diffraction line broadening, scanning electron microscopy (SEM), and transmission electron microscopy were also employed in order to complement the chemisorption results as well as evaluate the assumptions associated with selective gas chemisorption.

11647 **(EGG-M—22482) Effects of coal-gasification atmospheres on pressurized tubes.** Smolik, G.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 8p. (CONF-821037—51). NTIS, PC A02/MF A01. Order Number DE83003252.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

Tests of the four alloys in medium-Btu environments have not shown reductions in life, relative to air, at test temperatures of less than 1090 K (1500°F). This is demonstrated for Incoloy 800H and Haynes 188 in Figures 1 and 2, where data for the entire temperature range has been presented on rupture parameter (Larson-Miller) plots. Data for both air and CGA tests ($T < 1090$ K) correlate very well with mean curves determined for uniaxial data. Data for 310 SS and IN-657, presented elsewhere, paralleled the curves for mean uniaxial curves, but were displaced to lower stress values. These displacements were attributed to microstructural heterogeneities, i.e., banking and porosity present in 310 SS in IN-657, respectively. All the CGAs were oxidizing at these lower temperatures as evidenced by the formation of adherent oxide layers. Specimens tested in CGAs at 1255 K (1800°F) showed reduced lifetimes relative to tests performed under constant stress in air. Possible causes of these reductions appear to be alloy dependent. Scanning electron microscopy and energy dispersive x-ray analysis verified sulfide scale formations and sulfur penetrations into specimens of Incoloy 800H and IN-657. Metallography revealed that some of these sulfide deposits had become molten and produced substantial, sometimes complete, wall penetration. Cycling loading, an inherent feature of the high pressure test system, appears to have caused reductions in lifetimes of Haynes 188 specimens tested at 1255 K (1800°F). Samples of Incoloy 800H exposed in a simulated low-Btu environment at 1088 K (1500°F) experienced more severe corrosion than those exposed in the Reference CGA (medium-Btu). The samples exposed in the low-Btu environment displayed molten corrosion products indicative of a low melting point eutectic formed from sulfides. Metallography confirmed that complete wall penetration, 0.56 mm (0.022 in.), occurred for these tests in less than 100 h.

11648 **(EPRI-AF—1179-Vol.2) Simulation of a Texaco gasifier. Volume 2: an unsteady-state model. Final report.** Lupa, A.J. (Texaco, Inc., Houston, TX (USA)). Oct 1982. 41p. NTIS, PC A03/MF A01. Order Number DE83900895.

A simple, steady-state model of an entrained pilot plant gasifier has been extended to include the simulation of transient operation. The model results were compared with unsteady-state data from experimental tests of the pilot plant (15 TPD) gasifier at Texaco's Research Laboratory at Montebello, California. It was shown qualitatively that the model can satisfactorily predict experimental transients. A quantitative validation could not be obtained because of equipment limitations at the pilot plant. The gasifier simulation model was intended to interpret the results of pilot plant studies, to verify simplified models for GCC plant control analyses, and to evaluate gasifier design alternatives. During the ourse of this project, the simulation was applied with reasonable success for such applications. The simplified model is based upon proprietary Texaco information, and the computer code is not available to the general public. However, provisions were made to supply EPRI with required simulation results under confidential agreement.

11649 (GFETC/IC—82/1, pp 92-106) **Great Plains Gasification Associates project: the nation's first commercial synthetic fuels plant.** Fodor, R.J. (ANG Coal Gasification Co., Detroit, MI). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

North Dakota was selected in 1970 as being most ideally suited of the 48 contiguous states for the development of a gasification complex. In 1972, lignite reserves were leased. The subsequent history of the project is reviewed including formation of the Great Plains Gasification Associates consortium. In 1978, construction was started on Phase I, a 125-million cu ft/day SNG plant, with removal of topsoil. Financing plans have delayed construction, but these should be resolved in time to take advantage of the 1981 construction season. The gasification process and mine development are described. The lignite surface mine will also furnish lignite for two 450-MW electrical generating units in addition to Phase I requirements. Mine design is expandable to 14.6 million tons/y, which is adequate to also supply the lignite for Phase II of the gasification process. Models of process units are shown, the construction schedule estimated, and financial plans discussed.

11650 (GFETC/IC—82/1, pp 347-348) **Transco medium-Btu lignite gasification project.** Leva, D. (Transco Synthetic Fuels Co., Houston, TX). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Transco is studying a lignite gasification project which converts 16,500 tpd (6 million tpy) of East Texas lignite to 125 billion Btu (125 Btu of medium-Btu fuel gas (equivalent to 21,600 bpd oil equivalent) for sale to Houston Lighting and Power Company (HL and P) as boiler fuel for an existing natural gas-fired generating station. The gasification plant will be constructed in Robertson County, Texas, near the town of Franklin, and transported by a dedicated pipeline to HL and P's existing P.H. Robinson Generating Station in Galveston County, Texas. The project is currently in the feasibility study stage, having been selected for feasibility study cofunding in the Department of Energy program for feasibility studies and cooperative agreements for synthetic fuels development. The feasibility study is scheduled for completion in 1982. Assuming that the feasibility study verifies the suitability of the project for further development, design engineering and permitting work can begin in 1982, leading to the start of construction in the summer of 1985. Construction for the project should require just over 3 years to reach mechanical completion, followed by a period of approximately 12 months during which the project will be brought up to full nameplate production capacity by January 1, 1990.

11651 **(IITRI-M—06087-D) Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant.** Yurkewycz, R.; Firestone, R.F. (IIT Research Inst., Chicago, IL (USA)). Oct 1982. Contract W-7405-ENG-26. 91p. NTIS, PC A05/MF A01. Order Number DE83005471.

Corrosion monitoring of materials was conducted in the operating environment of the IGT U-GAS coal gasification pilot plant between 1977 and 1982. Metal and refractory specimens were exposed in the fluid bed gasifier in the freeboard section. Metal coupons were also exposed in two test locations in the product gas scrubber and venturi collection tank. Exposure times (coal feed to gasifier) were 264 h, 392 h, and 981 h. The corrosion performance of most alloys in the first exposure compared to the second and third in the U-GAS gasifier freeborad section was quite different. The more aggressive conditions produced during the first-exposure period are attributed to processing of unwashed high-sulfur coals in the steam-air gasification mode. Of the group of alloys evaluated, alloy 6B showed acceptable corrosion performance in all three exposures. Although their performance was poor in the first period, alloys N155 and IN-671 showed marked improvement in corrosion resistance during the second and third exposure periods. The same was true of cobalt-base alloy 188 which was the best performing alloy in the second and third exposures. Pack-aluminized alloys IN-800 and Type 310 showed acceptable performance. Conditions at the coupon location in the product gas scrubber (off-gas) were extremely aggressive to a range of materials exposed except titanium 50A. In the product-gas scrubber sludge tank and venturi collection

tank, only carbon steel A515 showed significant attack; in some cases Types 410 and 430 incurred only mild pitting attack. Exposure in the gasifier freeboard had no significant effect on refractory specimens.

11652 **(IS-T—1006) Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts.** Whitmoyer, D.E. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 78p. NTIS, PC A05/MF A01. Order Number DE83004975.

Thesis. Submitted to Iowa State Univ., Ames.

Ru/Al_2O_3, Re/Al_2O_3 and $Ru\text{-}Re/Al_2O_3$ catalysts were synthesized and characterized. A kinetics study was conducted for the methanation reaction on each of these catalysts using a Berty reactor. Operating conditions for kinetic experiments were 200 to 260°C and 35 to 40 atm. Hydrocarbon products were detected by a gas chromatograph. It was found that the Ru/Al_2O_3 and Re/Al_2O_3 gave similar activation energies. The $Ru\text{-}Re/Al_2O_3$ catalyst gave a significantly higher activation energy. Kinetic orders with respect to carbon monoxide and hydrogen were determined. Two mechanisms were proposed, one for the Ru/Al_2O_3 and Re/Al_2O_3 catalysts and one for the $Ru\text{-}Re/Al_2O_3$ catalyst, from which the experimentally observed reaction orders could be derived. An Auger electron spectroscopy study was conducted on a 50:50 atom percent ruthenium-rhenium alloy to determine surface segregation. No surface segregation was observed even after heating the alloy for two weeks at 1050°C. 22 figures, 9 tables.

11653 **(ORNL/SGMP—82/2) Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982.** (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 71p. NTIS, PC A04/MF A01. Order Number DE83005167.

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The objective of the Surface Gasification Materials Program is to conduct research and development on materials for application to the specific needs of coal gasification systems. The Program is divided into two subprograms: (1) the Gasification Systems Fabrication Technology Program and (2) the Materials Application and Development Program. The purpose of the Gasification Systems Fabrication Technology Program is to evaluate innovative fabrication methods which have the potential to lower costs and improve reliability and safety for gasifier vessels and components. The purpose of the Materials Application and Development Program is to conduct engineering-scale development and application of materials for coal gasification systems to ensure that the materials of construction for pilot plants and future large-scale plants can be properly selected and specified. The Morgantown Energy Technology Center (METC), in its lead role for gasification projects, is responsible for ensuring that the Surface Gasification Materials Program is responsive to the needs for gasification systems. Under its lead role for fossil energy materials, the Oak Ridge Operations Office (ORO), is responsible for the planning, implementation, and management of the program in accordance with guidance received from METC. The ORNL Fossil Energy Materials Program Office compiles and issues this combined semiannual progress report from camera-ready copies submitted by each of the participating organizations.

11654 **(ORNL/TM—8406) Techno-economic assessment on the utilization of surge-leg pumps in coal liquefaction.** Conley, T.B. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 77p. NTIS, PC A05/MF A01. Order Number DE83005175.

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Conventional reciprocating slurry pumps have experienced numerous failures in coal-liquefaction pilot plants and process development units. The frequency of these failures dictates caution with respect to their use in projected commercial-liquefaction facilities. The question has been raised of the viability of reciprocating pumps with clean liquid surge legs as an alternative to conventional reciprocating models for use as the primary pumps for dissolver feed and vacuum tower bottoms. In order to evaluate this question, a techno-economic assessment of the adaptability of surge leg pumps' to these applications has been performed. The information used was gathered from literature searches as well as from written and verbal communications with industrial participants (users and manufacturers). The advantages and disadvantages of surge leg pumps have been considered compared to those of the conventional pumps presently used in the pilot plants and to those projected for use in the commercial plants. The assessment included an examination of the pumps' technical, practical, and economic viability in liquefaction services and of the design areas where further study is desirable. This paper is a summary of the important findings. The overall conclusion reached is that surge leg pumps represent a technically viable and economically competitive alternative to conventional reciprocating slurry pumps for use as the dissolver feed and the vacuum tower bottoms primary pumps in projected commercial coal liquefaction facilities.

11655 **(ORNL/TM—8438) Coal slurry mixing: residence time and temperature effects on SRC feed slurries.** Johnson, J.K.; Dickerson, L.S.; Rodgers, B.R.; Youngblood, E.L. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 154p. NTIS, PC A08/MF A01. Order Number DE83005177.

The initial steps of all direct coal-liquefaction processes include the mixing of a process-derived solvent with the ground coal. Typically, the solvent is cooled prior to the mixing step. If the operating temperature of the slurry mixing system could be increased, the size of the solvent cooler would be reduced and, in turn, the load on the slurry preheater would be decreased. Because of the potential advantages in thermal efficiency and capital cost, studies were conducted to determine the feasibility of operating the slurry mixing system at temperatures up to 505 K (450°F). The behavior of feed slurries representative of those used at the SRC pilot plants located at Ft. Lewis, Washington, and Wilsonville, Alabama, was studied in this investigation. These slurries, with coal concentrations of 38.5 wt %, were tested at temperatures from 300 to 507 K (80 to 453°F) to determine the effects of temperature and residence time on their physical properties, particularly viscosity. Operation of a demonstration plant or a production facility with the Wilsonville slurry might be more difficult at higher mixing temperatures because of the solids settling and the problems associated with deposits in the equipment. Overall, the Ft. Lewis slurry behaved much more satisfactorily, although some minor buildups did occur in the system. An appendix has been entered separately.

11656 (ORNL/TM—8438, pp 129-146) **9.6 appendix F: analysis of rheological data for SRC solvent coal slurries: Ft. Lewis and Wilsonville solvents.** (Richard W. Hanks Associates, Inc., Orem, UT). Jan 1983. NTIS, PC A08/MF A01. Contract W-7405-ENG-26.

In Coal slurry mixing: residence time and temperature effects on SRC feed slurries.

The analysis has shown that a number of different phenomena are reflected by the ORNL viscometric data for the two different SRC solvent coal slurries. The Ft. Lewis solvent slurries clearly exhibit the phenomenon of wall slip. The data for the slurries indicate a change in rheological behavior from Bingham plastic to dilatant with increase in temperature. The Wilsonville solvent data were not sufficiently extensive to permit evaluation at two different temperatures. The one set of these latter data which could be analyzed, however, clearly indicated the absence of any wall slip effects, the existence of turbulent flow over about half of the range of the data, and were very well represented by the Casson model rather than the Bingham plastic model. We stress the following word of CAUTION in considering the above conclusions. The data presented to use were very meager. If possible in the future, all data obtained should involve at least 6 to 8 different values of flow rate, and preferable 10 to 12 to allow statistically significant data analyses to be performed. This will also help greatly in the identification of turbulence. This is not at all clear from the raw data and is no doubt obscurred by the presence of the pronounced wall slip phenomenon exhibited by the data. The analysis of the Wilsonville solvent slurry data, well much more firmly based than that of the Ft. Lewis solvent slurry data, is still somewhat tentative because it is based entirely upon two flow rates. We finally conclude from these data that the SRC solvent coal slurries are definitely non-Newtonian in character and that the rheological behavior of the two different solvents is different.

11657 (SAND—82-8882, pp 151-178) **Time-resolved weight loss kinetics for the rapid devolatilization of a bituminous coal.** Niksa, S.; Russel, W.B.; Saville, D.A. (Princeton Univ., NJ). Oct 1982. NTIS, PC A08/MF A01.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

The weight loss kinetics for the rapid devolatilization of a vituminous coal were measured over broad ranges of temperature (to 1000°C) and heating rate (10^3 to 10^4 K/s) in vacuum. The reaction period was resolved in 0.1 s time increments with rapid quenching. In addition, the effects of pressure (13.3 Pa to 10 MPa) and particle size (50, 85, and 125 μm) were studied. We found that the rate of generation of volatiles increases slowly with temperature and is relatively insensitive to pressure changes. However, the heating rate does affect the devolatilization rate and the total yield. Below 600 C, two stages of product evolution were observed, one with and the other without coliberation of tarry liquids. At higher temperatures these two stages coalesced. Although the concept of simultaneous, parallel reactions can account for the low apparent activation energy of the first stage of the devolatilization process, a multiple reaction model with a Gaussian activation energy distribution does not adequately describe the total time-temperature history. In addition, extant models with competitive rate processes to describe the redeposition of volatiles and their escape from the particle seem incompatible with the effects of particle size and heating rate observed in vacuum. 9 figures, 2 tables.

11658 (SERI/CP—234-1590, pp 41-59) **Comparison of coal and wood as feedstocks for methanol manufacture.** Graboski, M.S. (Colorado School of Mines, Golden). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

In the gasification of coal or wood to methanol, wood is shown to be more economical as a feedstock. Wood is more reactive with oxygen and steam, doesn't require complex processes to rid the gas product of sulfur or ammonia, and can be gasified on a small scale which would minimize socio-environmental impacts around the plant site. With current interest rates, small plants are becoming more attractive, and small plant economy gives wood a big advantage over coal.

11659 (SERI/CP—234-1590, pp 61-77) **Peat as a feedstock to the KBW gasification process.** Oster, L.A. (Koppers Co., Inc., Pittsburgh, PA); Michaels, H.J. 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

The KBW (Koppers, Babcock and Wilcox) Gasification process is a commercial process for converting coal to synthesis gas and subsequent methanol production. Koppers is currently conducting a feasibility study to convert North Carolina peat into methanol. Tests have been completed which show that peat can be successfully dried and pulverized to the characteristics required for the KBW gasifier. These tests coupled with logical correlations with coal gasification experience indicate that peat gasification is viable. The KBW entrained flow gasifier and gas cooling and cleaning system is discussed. The advantages of using the KBW gasifier for methanol synthesis are highlighted. Finally, an overview of the North Carolina peat-to-methanol plant feasibility study is given.

11660 **(SSS-R—81-4685-Vol.1) Systems model of the iron oxide hot-gas clean-up process. Volume 1. Theoretical and experimental results. Final report, September 1979-December 1980.** Alexander, J.H.; Blake, T.R.; Brownell, D.H. Jr.; Hasatani, M.; Tamhankar, S.S.; Tseng, S.G.; Wen, C.Y.; Wilkins, D.E. (Systems, Science and Software, La Jolla, CA (USA)). Apr 1981. Contract AC21-79MC12135. 132p. NTIS, PC A07/MF A01. Order Number DE83002682.

Theoretical and numerical models of fixed bed H_2S absorption columns were developed in the present research. These models provide transient descriptions of the breakthrough behavior of the bed and of the temperature excursions associated with the chemical reactions. There are two categories of models. The first of these is an extension of the classical constant pattern solutions to the representation of reduction, sulfidation and regeneration in the column. The second category of model uses a finite difference method to provide a detailed description in time and length of the column, of the multi-component gas flow, the conversion of sorbent, and associated temperature distribution during column operation. The finite difference model can also be operated in concert with unit process models for heat exchangers, knockout drums and interconnecting lines that typify a flow sheet for an H_2S removal system. Both the constant pattern model and the finite difference model can also be applied to moving beds.

11661 **(SSS-R—81-4942-Vol.2) Systems model of the iron oxide hot gas clean-up process. Volume II. Hotgas user's manual. Final report, September 1979-December 1980.** Wilkins, D.E. (Systems, Science and Software, La Jolla, CA (USA)). Apr 1981. Contract AC21-79MC12135. 57p. NTIS, PC A04/MF A01. Order Number DE83002823.

The HOTGAS code is a computerized implementation of models for process units which are used in the Morgantown Energy Technology Center (METC) H_2S - Hot Producer Gas Cleanup Process. The types of process units that have been modeled include absorption and regeneration towers, heat exchangers, heaters and separators. The code is modular and can accommodate models of other types of units provided they are equipped with standard HOTGAS interfaces. This manual discusses methods for simulating a variety of closed loop and open loop configurations including individual units.

11662 **(TENRAC/EDF—039) Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report.** (Radian Corp., Austin, TX (USA)). 10 Mar 1981. 423p. NTIS, PC A18/MF A01. Order Number DE83900695.

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Because of the newness of coal gasification technology application in the US and in Texas, however, the introduction of MBG technology may be constrained by limitations in environmental information and regulatory procedures. The objective of this report is the identification of gaps and conflicts in existing regulations which may influence the course of industrial lignite utilization in Texas and the maintenance of environmental quality. Topics addressed include: environmental impacts likely to be encountered from industrial lignite use; environmental factors associated with gasification and direct firing of lignite which may need to be considered in decision-making affecting the course of lignite utilization; existing state and federal framework for regulating industrial use of lignite; and regulatory gaps, conflicts, and constraints which may inhibit public and private industry initiatives to pursue the synfuels option. In seeking to accomplish this objective, the report compares and contrasts the major environmental impacts and regulatory requirements associated with two alternatives for industrial use of lignite. The first alternative (or scenario) assumes that lignite is converted to MBG in a minemouth Lurgi gasification plant and shipped by pipeline to coastal industry where it is used in existing industrial boilers originally built to use natural gas. The second scenario assumes the transportation of lignite by rail to coastal industry and the construction of new boilers designed specifically to burn lignite.

11663 **(UCRL—52000-82-11) Energy and technology review.** (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 38p. NTIS, PC A03/MF A01. Order Number DE83003802.

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Separate abstracts were prepared for each of the three included sections.

11664 (UCRL—52000-82-11, pp 1-13) **Large-block experiments in underground coal gasification.** Nov 1982. NTIS, PC A03/MF A01.

In Energy and technology review.

Neither the composition of the product gas nor the cavity shape varied significantly with the ratio of injected steam-oxygen or with its flow rate over the range tested. The general shape of the air-burn cavity did not differ from those of the steam-oxygen burns. The pressure that built up during the burns was almost certainly due to the formation of the large rubble zones in the burn

cavities. Rubble builds up from the collapse of coal dried by the hot product gases, and the burn proceeds by oxidizing the rubble in the vicinity of the injection point. Burn cavities tend to be higher than they are wide, a natural consequence of their growth by shrinkage-induced collapse. So long as the cavity remains entirely in the coal, the rubble pile grows faster than it is consumed. The product gases flow through the interstices of the rubble pile (and through temporary channels formed by the gas in the rubble pile) to the exist channel. Because the gas flows through a bed of coal rubble, its quality is consistently high and quite constant with time. The CRIP experiment successfully demonstrated the technique of retracting the injection point and the feasibility of establishing a new burn zone. Because the first burn period was too short to consume the rubble pile and thus cause the heating value of the product gases to decline, the CRIP test did not produce any significant improvement in gas quality. We are confident that such an improvement would occur in a longer test.

11665 **Thermolysis of model compounds for coal. 2. Condensation and hydrogen transfer during thermolysis of naphthols.** Poutsma, M.L.; Dyer, C.W. (Oak Ridge National Lab., TN). *Journal of Organic Chemistry;* 47: No. 18, 3367-3377(27 Aug 1982). Contract W-7405-ENG-26.

The dominant initial products from thermolysis of 1-naphthol in the liquid phase at 400°C are 2,2′-binaphthalene-1,1′-diol (2) and 1-tetralone (6).As reaction proceeds, binaphthol 2 undergoes rapid cyclization to dinaphtho[1,2-b:2′,1′-d]furan (1), while ketone 6 is more slowly converted ultimately to naphthalene (8). The initial rate of this ring coupling and hydrogen-transfer reaction shows an apparent kinetic order of ~2.5 in m-terphenyl diluent. In benzophenone solvent, formation of coupled binaphthol 2 is accelerated, but reduced product 6 is replaced by diphenylmethane. Thermolysis of 2-naphthol behaves similarly except that coupling occurs both between C-1 and C-1′ to give dinaphtho[2,1-b:1′,2′-d]furan (3), preceded by 1,1′-binaphthalene-2,2′-diol (4), and between C-1 and C-3′ to give dinaphtho[2,1-b:2′,3′-d]furan (5). The major reduction product is 2-tetralone (14). The ratio of (3 + 4)/5 decreases with increasing reaction time. Mechanistic hypotheses for this characteristic thermal behavior of phenols are explored.The significance of the reactions involved for conversion processes for coal, which contains significant phenolic functionality, is discussed.

0105 By-products

REFER ALSO TO CITATION(S) 11727, 11985

0106 Properties

REFER ALSO TO CITATION(S) 11608, 11613, 11632, 11636, 11657, 11683, 11752, 11770, 12750, 12755, 12758

11666 (DOE/ET/10159—T25, pp 95-105) **Peat testing standardization.** Jarrett, P.M. (Royal Military Coll. of Canada, Kingston, Ontario). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The standard test methods for peat in part 19 of the 1982 ASTM Book of Standards are listed by number and title. Current work on developing or modifying tests on peat is discussed. Some problems considered are: the effects of ashing temperature on the ash content (due to the disintegration of clays at temperatures above 400°C). The degree of decomposition and the rate of decomposition as it dries (the effect of temperature); and problems of determining density. (LTN)

11667 (DOE/ET/10159—T25, pp 253-292) **Wet oxidation of peat.** Copa, W.M.; Canney, P.J. (Zimpro, Inc., Rothschild, WI). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Peat used in the current bench-scale studies was a reed sludge peat obtained from Minnesota Iron Range Resource and Rehabilitation, Eveleth, Minnesota. Characterization of this peat is reported in Table I. A statistically designed experiment to investigate the use of wet oxidation to improve peat dewaterability and enhance its fuel value was performed. Results indicated significant effects due to variations in temperature, oxygen charged, and initial solids concentration and to the presence or absence of a $CaCO_3$ buffer. Reaction time had very minor effects on oxidation characteristics. Several significant interactions between factors were also observed.

11668 (DOE/ET/10159—T25, pp 293-318) **Alkaline oxidation of peat.** Levy, P.F.; deRiel, S.R.; Sanderson, J.E.; Wise, D.L. (Dynatech Research and Development Co., Cambridge, MA). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The complete wet oxidation of peat, with the evolution of steam, may be used to provide process heat or generate electricity. The production of low molecular weight fermentable material by limited oxidation may be incorporated into a process using anaerobic fermentation and electrolytic oxidation to produce a mixed alcohol fuel. Following pretreatment of the peat, it is fed to an anaerobic fermenter. One option is to ferment the material to methane. In this present process, however, the fermentation conditions are adjusted to minimize methane formation and encourage formation of higher organic acids (butyric, valeric, caproic). This may require the presence of an electron acceptor such as sulfate or nitrate. The higher organic acids may be separated from the fermenter broth by liquid-liquid extraction into a hydrocarbon solvent such as kerosene. The acids then may be concentrated by back-extraction into an aqueous base. The acids are then electrolytically decarboxylated and oxidized to form mixed olefins. Butyric, valeric, and caproic acid mixtures will form a mixture of propylene, 1-butene, 2-butene (cis- and trans-), 1-pentene, and 2-pentene (cis and trans). The olefins may then be hydrated to form mixed alcohols. The fermentation, liquid-liquid extraction, and electrolytic oxidation steps of this process have already been demonstrated for polysaccharide substrates. Work is currently being performed to adapt this technology to processing peat. The key step in using peat as the substrate is in the fermentation to organic acids. Critical to this aspect of the process is the ability to convert a high percentage of the peat to a digestible material. This paper explores the effect of various parameters on the alkaline oxidative treatment of peat.

11669 (DOE/PC/30223—6) **Petrographic characterization of Kentucky coals. Quarterly progress report, September 1982 - November 1982.** Hower, J.C.; Ferm, J.C.; Cobb, J.C.; Trinkle, E.J.; Frankie, K.A.; Baynard, D.N.; Graese, A.M.; Raione, R.P.; Poe, S.H. (Kentucky Univ., Lexington (USA). Inst. for Mining and Minerals Research). 1977. Contract FG22-80PC30223. 10p. NTIS, PC A02/MF A01. Order Number DE83004282.

Kentucky coals have been studied by petrography and the maximum reflectance of vitrinite and pseudovitrinite. Pyrite and marcasite have also been studied in these coals and the results related to the depositional environment, in particular whether fresh or salt water. The depositional conditions is influence the sulfur content and the morphology of the pyrite. (LTN)

11670 (DOE/PC/40783—T8) **Instrumental methods of analysis of sulfur compounds in synfuel process streams. Quarterly technical progress report, July-September 1982.** Jordan, J.; Stahl, J.; Yakupkovic, J. (Pennsylvania State Univ., University Park (USA). Dept. of Chemistry). Oct 1982. Contract FG22-81PC40783. 23p. NTIS, PC A02/MF A01. Order Number DE83002685.

Task 1. Methods development for the speciation of the polysulfides. The investigation of the thermodynamics of competing reactions, which may interfere in the thermometric titration of polysulfides with the reagent p-hydroxymercuribenzoate, was completed. The reactions are described by the general equation, ⁻OOC phi HgOH + Nu/sup z/ = ⁻OOC phi HgNu/sup z+1/ + OH^- where Nu is a nucleophile and z is ≦ O denotes a charge number. Values of log K and ΔH/sub r/⁰′ are reported for the following nucleophiles: S^{-2}, S/sub x/$^{-2}$, CN^-, $S_2O_3^{-2}$, I^-, SO_3^{-2}, NH_3, SCN^-, all of which are significant contaminants in coal conversion process streams. Electroreduction of polysulfides to HS^- at the dropping mercury electrode has been found to yield diffusion controlled polarographic limiting currents. These are amenable to the determina-

tion of polysulfidic sulfur in a range of concentrations between 5 x 10^{-6} M and 3 x 10^{-3} M. Task 2. Methods development for the speciation of dithionite and polysulfides. Classical chemical methods of polythionate analysis will be the starting point in the development of new thermochemical approaches for the speciation of the moieties $S_2O_6^{-2}$, $S_3O_6^{-2}$, $S_4O_6^{-2}$, $S_5O_6^{-2}$, and $S_6O_6^{-2}$. Task 3. Total accounting of the sulfur balance in representative samples of synfuel process streams. Arrangements have been completed for the shipment of the first set of representative specimens. Precautions will be taken to prevent alternations en route. 12 figures, 2 tables.

11671 **(DOE/PC/40789—T4) Thermal and radiative properties of coal-ash deposits. Technical progress report No. 4, September 1-November 30, 1982.** Anderson, D.W.; Vader, D.T.; Zumbrunnen, D.A.; Incropera, F.P.; Viskanta, R. (Purdue Univ., Lafayette, IN (USA). School of Mechanical Engineering). 1982. Contract FG22-81PC40789. 11p. NTIS, PC A02/MF A01. Order Number DE83004135.

The topics discussed in the last progress report have been addressed and several of the tasks completed. Efforts have been directed to three primary areas: (1) cooling water flow loop, (2) evaluating methods for characterizing test specimens, and (3) planning a final dry run (no thermal loading) test of the high temperature kiln. Prediction of heat transfer through coal ash deposits requires knowledge of deposit radiative properties. Ultimately, it would be desirable to have not only emittance but also absorption coefficient, scattering coefficient, as well as scattering phase function data for deposits. Development of a facility to measure the emittance of a porous and particulate media has been initiated. The literature has been surveyed for descriptions of techniques previously used to make high temperature emittance measurements. One widely used technique requires measurements of emitted flux from a real body and from a black body. By definition the ratio of emission from a real body to emission from a black body at the same temperature is the emittance of the real material. An integral black body method will be used in this study. In this method coal ash deposit sample will be heated in the black body reference cavity itself thus insuring that the two are isothermal. It is important that the quality of the black body be good.

11672 **(DOE/PC/40793—T5) Predictors of plasticity in bituminous coals. Technical progress report No. 5.** Lloyd, W.G.; Reasoner, J.W.; Hower, J.C.; Yates, L.P.; Bowling, C.C.; Davis, E.; Whitt, J.M. (Western Kentucky Univ., Bowling Green (USA). Ogden Coll. of Science, Technology and Health). 1 Dec 1982. Contract FG22-81PC40793. 95p. NTIS, PC A05/MF A01. Order Number DE83004315.

The forty fresh coal samples have been obtained, and the proximate, ultimate and petrographic characterization on all samples is now completed. ASTM Gieseler plastometry analyses have been completed on all 40 coals, in quadruplicate, and the melting and coking slopes and intersection maximum fluidities have been estimated. Significant progress has been made in completing the nonstandard analyses which will provide an important part of the project database. Fifteen coals have been subjected to the 20-run sets of isothermal Gieseler analyses; the balance of this group is expected to be completed by mid-1983. Pyrolysis gas chromatogrpahy has been completed for 36 of the 40 coals. Quantitative extractions have now been completed for 32 of the 40 coals, both with tegrahydrofuran and with dimethylformamide. FTIR spectra have been obtained in sets of three (whole coal, residue from THF extraction, residue from DMF extraction) for 31 of the 40 coals. This report also includes a descriptive study by optical microscopy of selected coals and semi-cokes derived from these coals. Future work will include correlation analysis of the completed datasets, and an intensive study of the characteristics of six or seven coals selected from the present set.

11673 **(DOE/PC/40799—T5) Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, October 1-December 31, 1982.** Taylor, L.T. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Jan 1983. Contract FG22-81PC40799. 33p. NTIS, PC A03/MF A01. Order Number DE83004566.

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A liquid chromatographic, analytical-scale separation was optimized for neutral and slightly basic nitrogen compounds, phenols and alcohols. A Whatman PAC column was chosen because it was found that traditional strongly adsorbing molecules can be eluted from this column employing a reasonably IR transparent mobile phase with a small amount of polar modifier. When utilizing FTIR as a liquid chromatographic detector, it is important to consider both the chromatographic properties of the solvent used for the mobile phase and its infrared spectroscopic properties. If a solvent is not transparent over a relatively wide range of wavelengths or the solvent adsorbs in the region of several important functional groups, it will be a poor choice for the mobile phase. The mobile phase used here in conjunction with the PAC column was a binary phase of 98:2 $CDCl_3$:CH_3CN. The ir spectrum of this binary mobile phase is shown in Figure 2. It was found that phenols would not elute from the column with 100% chloroform with practical k' values unless a small amount of polar modifier was added. The use of deuterated chloroform shifted less absorbing ir bands to regions in which there was little interference with important functional groups. The amount of water present in the mobile phase and thus on the column was found to greatly affect the retention characteristics of the polar compounds. Therefore, eliminating water helped assure a constant level of column activation. The routine method of maintaining constant column activation in the normal phase mode by saturating the mobile phase with water could not be utilized here with ir detection due to the great absorptivity of water in the ir. Table I lists the polar models examined in this study and their retention volumes as obtained by single injection with $CDCL_e$-CH_3-CH_3CN elution and uv (254 nm) detection.

11674 (GFETC/IC—82/1, pp 414-422) **Some inconsistencies in current concepts of coal science.** Berkowitz, N. (Univ. of Alberta, Edmonton). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Three closely interrelated topics, all appearing to contain inherent inconsistencies, are discussed. The first concerns connections between the behaviour of coal in H-donors at $T > 400°C$ and coal solvolysis in non-donors at $T < 400°C$. The second focuses on hypotheses which associate the absence of caking propensities with ether-linkages in coal. The third centers on problems that arise when notions that coal is comprised of a three-dimensionally crosslinked molecular network are viewed in light of the action of solvents on coal. For discussion purposes, it is suggested that these largely interpretational problems can be resolved by assuming that coal is made up of branched, highly asymmetrical and physically entangled molecules, and that the metamorphic process - for all practical purposes synonymous with progresive compression of the coal material - entails gradual disentanglement and consequent, increasingly pronounced partial alignment of macro-molecules.

11675 (GFETC/IC—82/1, pp 423-441) **Chemical aspects of structure and liquefaction of bituminous coals.** Wiser, W.H. (Univ. of Utah, Salt Lake City). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The chemical structure of bituminous coal, from the point of view of converting that coal to liquids, is discussed. The manner in which this structure is attacked in coal liquefaction by various techniques is presented. Recent research results involving model compounds which may shed light upon some of the mechanisms of coal liquefaction is presented and discussed.

11676 (GFETC/IC—82/1, pp 442-470) **Structural characteristics and relationships in low-rank coals.** Benson, S.A.; Schobert, H.H. (Grand Forks Energy Technology Center, ND). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Coals of various ranks were studied by pressure differential scanning calorimetry (PDSC). PDSC is an instrumental technique which provides a direct calorimetric measurement of the heat of combustion or heating value; PDSC data generally compared very well with results obtained from traditional bomb calorimetric meth-

ods. The PDSC measurements are made in a 500 psig oxygen atmosphere at temperatures to 500°C. For most coals, the thermogram obtained from a PDSC experiment consists of one or two large, exothermic peaks. The number of peaks, the intensity of the peaks, and the temperatures at which they occur vary with the rank of the coal. Most peat samples give a thermogram having a single peak at low temperatures. The thermograms from lignite and bituminous coals normally have two peaks. As the rank increases from lignite through the bituminous coals, the higher temperature peak becomes increasingly predominant and tends to shift to increasingly higher temperatures. Anthracites produce a thermogram with a single high-temperature peak. The variations in the nature of the thermograms as a function of rank fit the paradigm of an increasing aromatic character and loss of aliphatic moieties in the progression from peat through lignite to the higher ranks of coal. PDSC experiments with model compounds provide substantiation of this observation. Some preliminary results suggest the possibility of deriving additional structural information from PDSC studies. The thermogram Rosebud subbituminous coal can be approximated by an appropriate linear combination of the thermograms of pyrene, naphthalene, fluorene and phenanthrene.

11677 **(IS-T—989) Direct determination of organic sulfur in coal by electron-beam microanalysis.** Straszheim, W.E. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 98p. NTIS, PC A05/MF A01. Order Number DE83004972.

Thesis.

Review of the literature indicates that ASTM methods of sulfur analysis in coal are quite susceptible to error due to insufficient HNO_3 penetration and due to altered iron and sulfur chemistries in both raw and processed coals. ASTM does not directly determine the organic sulfur content of coal but derives an organic sulfur estimate as the difference of total and mineral sulfur contents. Precision using such a scheme is reduced as uncertainty in the organic sulfur level represents the sum of the uncertainties in each of the other sulfur determinations. An electron beam microanalysis technique has been developed for directly measuring organic sulfur levels in coal based on measurements of a number of particles of the maceral vitrinite. Results using this technique afford an estimate of the precision of the technique on a sample-by-sample basis as well as an average organic sulfur value. Results of the direct technique agreed favorably with ASTM analyses for raw coals. Those samples for which the direct technique appeared to under-estimate organic sulfur showed by further independent analyses that the ASTM results were in error. The direct analysis technique was demonstrated on a number of chemically desulfurized coals. The variability information generated allows construction of confidence intervals about observed differences in sample means to establish precision. Generally, the direct technique showed less, if any, removal of organic sulfur than did the ASTM technique. 7 figures, 22 tables.

11678 **(IS-T—990) Improvement in the analysis of ashes from coal by spark-source mass spectrography.** Welcomer, T.D. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 113p. NTIS, PC A06/MF A01. Order Number DE83004968.

Thesis.

A material balance study was performed using spark source mass spectrography on Iowa and Colorado coal burned at the Iowa State University Power Plant. Sixty-two elements were analyzed in the influent coal, effluent bottom ash, fly ash from a primary dust collector, and fly ash from an electrostatic precipitator. The material balance was satisfactory for the majority of the elements. A computer application of the Franzen-Mauer-Schuy formula was developed to calibrate the photoplates. The results indicated an unexpected increase in the sensitivity of the emulsion due to increasing momentum of the ions. The suitability of three internal standards, Cu, Zr, and Ba, was examined for use in the material balance study. The relative sensitivity coefficients for the elements in low-temperature ashed coal and the effluent ashes were determined from the results of the analysis of twelve standard samples. The results of the analysis of ashed coal and other ashed by spark source mass spectrography were improved when line areas instead of peaks were measured, the mass spectral data were interpreted by computer methods, and an accurate calibration and computation scheme was developed. The enrichment of the elements in the effluent ashes was examined to determine the potential of these ashes as sources of some of these elements. 6 figures, 15 tables.

11679 **(NYSERDA—82-9) Evaluation of combustion and cleanup of SRC-II coal-derived liquid fuel.** Weller, S.W.; Kennedy, L.A.; Shaw, D.T. (State Univ. of New York, Buffalo (USA)). Oct 1982. 33p. Dept. of Communications, NYSERDA-Two Rockefeller Plaza, Albany, NY 12223.

Three different sets of experimentas of SRC-II heavy distillate coal-derived liquid fuel were carried out. First, the aging behavior of an SRC-II heavy distillate coal-derived liquid fuel was studied. It was found that initial O_2 absorption rates vary according to mixing rate, O_2 pressure, and temperature. Aging at 50° also produces steady increases in viscosity, which may cause handling, pumping and storage difficulties. Another series of experiments was carried out at atmospheric pressure to clarify the influence of fuel properties and combustor parameters on NO/sub x/ formation. These bench-scale studies indicate the following: (1) Fuel nitrogen content is the primary composition variable affecting fuel NO/sub x/ formation in liquid fuels, with NO/sub x/ emissions increasing as the fuel nitrogen content increases. (2) Staged combustion dramatically reduces both fuel and thermal NO/sub x/ formation, with minimal emissions occurring at a primary zone equivalence ratio between 0.75 and 0.85, depending on combustion conditions. A third set of experiments involved investigation of combustion-generated particulates. It was found that particulates generated by combustion of SRC-II are highly irregular in shape and have a similar physical appearance to those particulates found in diesel engine emissions. Most of these particles have diameters of less than 4 microns, with the peak diameter in the submicron range. Full aging of an SRC-II heavy distillate coal-derived liquid fuel increases its viscosity, which in turn increases combustion smoke emissions. Total particulate emission and mass loading ($lbs/10^6$Btu) would not be aggravated by these emissions, nor would the emissions create problems when the SRC-II fuel is used to run a gas turbine. The particles' very large surface area may lead to significant increases in mutagenic activity due to atmospheric aging and photochemical conversion. 20 figures, 4 tables.

11680 **Experimental study of heat transfer through coal-ash deposits.** Fetters, G.D.; Viskanta, R.; Incropera, F.P. (Purdue Univ., West Lafayette, IN). *American Society of Mechanical Engineers, [Paper]*: 1-6(1982). Contract FG22-81PC40789.

Experiments have been performed in an electrically heated laboratory furnace to measure the effective thermal conductance of coal-ash deposits formed in a utility boiler. Samples were placed in a shallow tray having a cooled metallic substrate and were irradiated from above by the walls and ceiling of the furnace. From measurements of the temperature difference and average heat flux across a sample of crushed coal-ash deposit its mean effective thermal conductance was found to range from approximately 0.4 W/m°C at 400°C to 1.2 W/m°C at 900°C. Results are within the range of values reported by other investigators for coal-ash deposits of varying composition.

0108 Waste Management

REFER ALSO TO CITATION(S) 11640, 11732, 11742, 11743, 11759, 11768, 11822, 12282, 13051

11681 **(ANL/LRP-TM—22) Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs.** Bogner, J.E. (Argonne National Lab., IL (USA)). Aug 1982. Contract W-31-109-ENG-38. 161p. NTIS (US Sales Only). Order Number DE83002715.

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Development of coal-gasification and -liquefaction facilities in the Fort Union region of the northern Great Plains makes this section of the country a logical focus of attention in regard to disposal of solid wastes related to coal conversion plants. Proposed gasification facilities in the region will use primarily the Lurgi

fixed-bed process. Solid and semisolid wastes, which are created by coal mining and by the conversion plants themselves, include mine spoil, ash, char, inorganic sludges, tar/oil sludges, biosludges, and spent catalysts. A typical large gasification plant (with an output of 2.5×10^8 standard ft^3/day) may produce 1500 tons of solid waste per stream day. Disposal is expected to be primarily by burial in the mine pit. The environmental problems associated with synfuels waste disposal are related to soils and ecosystems, hydrology, air quality, and effects on man. Because relatively little research has been done on synfuels wastes and their effects, it is essential that long-term investigations begin immediately on potential regional problems associated with these wastes. Appendices contain schematics of coal liquefaction and coal gasification processes.

11682 **(DOE/ET/13046—T82) IGT U-GAS pilot plant scrubber effluent analysis.** Bodamer, J.W. Jr. (Energy Impact Associates, Inc., Pittsburgh, PA (USA)). Aug 1979. Contract AC02-77ET13046. 40p. NTIS, PC A03/MF A01. Order Number DE83003159.

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This report gives the analytical results from wastewater samples collected from the scrubber at the Institute of Gas Technology's U-GAS pilot plant under three different sets of operating conditions, including start-up and steady-state. This work was performed to provide data that could be used in the design of wastewater treatment facilities for the proposed Memphis Industrial Fuel Gas Demonstration (IFGD) plant that is to use the U-GAS gasifier. The scrubber effluent was analyzed for trace elements, inorganic constituents and organic species (including hazardous organics) in order to determine its composition. For purposes of comparison to the operation of other gasifier operating conditions, the results from one of the samples collected was normalized to pounds of constituent produced per 1000 pounds of coal consumed. Results indicate that the U-GAS gasifier produces a fairly clean scrubber effluent stream. Ammonia is the major potential pollutant at significant concentrations. Aluminium, boron and iron are found at appreciable concentrations, but there are indications that iron is associated with particulate matter and easily removed from the waste stream. Polycyclic aromatic hydrocarbons (PAH) comprise the majority of hazardous organics present in the wastewater, but their concentration is low. PAH concentrations, moreover, along with the other organics present, substantially decrease with better coal conversion efficiency, as pressure is increased and the gasifier reaches steady-state conditions.

11683 **(DOE/FC/10200—T4) Chemical and physical characterization of western low-rank-coal waste materials. Part 3. Sludges from wet scrubbers using fly ash as a scrubbing reagent. Final report.** (Radian Corp., Austin, TX (USA)). Dec 1982. Contract AC18-80FC10200. 320p. NTIS, PC A14/MF A01. Order Number DE83005165.

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The Department of Energy Grand Forks Energy Technology Center has supported development of wet scrubbers that use western fly ashes to supply all or part of the alkalinity requirements of the FGD system. Investigations described in this report address waste characteristics affecting disposal requirements for sludges from these systems. This program has two objectives. One is to determine disposal-related characteristics of sludges from FGD systems using fly ash as a major source of alkalinity. The second objective is to evaluate material-related disposal requirements for these sludges. In this study, two of the sludges were treated to increase physical stability and reduce permeability. Treatment involved application of three commercial fixation processes. And, in addition, fly ash scrubber sludge was treated by adding fly ash from an electrostatic precipitator. Treated and untreated sludges were subjected to a variety of chemical and physical tests. Elemental concentrations were measured in sludge solids and leachates obtained from column studies and sequential batch extractions. The EP extraction was carried out to classify sludges as nonhazardous or hazardous. Other measurements included: moisure content, bulk densities, densities of solids, surface areas, particle size distributions, strengths, and permeabilities. Element concentrations in sludge solids were generally within the expected limits. Calcium concentrations were generally lower in sludges from systems employing fly ash as reagent than would be expected for sludges from systems using limestone or lime. Sodium concentrations were higher in sludges from systems using fly ash from lignite than in sludges from other systems. All materials tested would be classified as nontoxic according to the characteristic of EP toxicity as currently defined.

11684 **(DOE/FC/10297—T4) Anaerobic treatment of gasifier effluents. Quarterly report No. 5.** Cross, W.H.; Chian, E.S.K.; Pohland, F.G.; Giabbai, M.; Harper, S.R.; Cheng, S.S.; Lu, F. (Georgia Inst. of Tech., Atlanta (USA)). Sep 1982. Contract AC18-81FC10297. 11p. NTIS, PC A02/MF A01. Order Number DE83001864.

This report summarizes the work performed during the period from July 1, 1982 through September 30, 1982 on the DOE research program on Anaerobic Treatment of Gasifier Effluents (Contract No. CE-AC18-81FC10297). The major efforts have been directed toward reacclimation of two of the anaerobic treatment systems, continued steady state operation of the third system at an ~ 10% raw wastewater loading and operation of a nitrification system on full strength effluent from the third anaerobic treatment system. The progress of these efforts is depicted along with project expenditures for the above contract.

11685 **(DOE/MC/16229—T5) Configurational testing of electron-beam ionization for coal-fly-ash precipitators. Quarterly report No. 5, December 2, 1981-March 1, 1982.** Davis, R.H. (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1982. Contract AC21-81MC16229. 27p. NTIS, PC A03/MF A01. Order Number DE82019415.

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The emphasis was on in-house machine shop and electronic shop work to manufacture the internal parts of the electron-beam-precipitator test system which was delivered during the last quarter (See Quarterly Report No. 4). Substantial progress was made on all of the subsystems: precharger, collector, aerosol generator, monitor, particle detector, and data analysis. Members of the F.S.U. Electron Beam Precipitator Development Group organized and participated in an Electron Beam Workshop held February 25 and 26 in Arlington, Virginia and the proceedings of that workshop have been published in a separate report. Work on model gas ionization experiments which are related to the possibility of combined treatment proceeded during this quarter.

11686 (GFETC/IC—82/1, pp 349-361) **Coyote FGC system: a status report on a spray dryer/baghouse combination.** Gehri, D.C. (Rockwell International, Canoga Park, CA); Lewis, M.F.; Menze, V.H.; Reid, A.B. Jr. 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The Coyote Flue Gas Cleaning (FGC) System is the first of many dry scrubbing systems that will be used for SO_2 and particulate control on commercial utility boilers. Equipment checkout and preoperational testing were completed in December, 1980. After a delay to resolve the Coyote Station's turbine generator problems, start-up testing of the FGC system commenced on March 27, 1981, with primary focus on the operation of the first-stage spray dryers. Precoating of the bags in the second-stage fabric filter was completed on May 15, 1981. The complete two-stage, dry FGC system is now undergoing various start-up and operational tests as a part of a 1440-hr operational demonstration. Upon completion of that demonstration, acceptance tests will be conducted to verify performance guarantees. This paper provides a brief description of the Coyote FGC System with emphasis on the current status of start-up and operational activities. Problems encountered to date are itemized along with actions taken or planned to resolve those problems. The general objectives of and the tentative schedule for the operational demonstration and the acceptance tests are also discussed.

11687 **(TENRAC/EDF—042) Impact of RCRA (PL 94-580) on the use or disposal of solid wastes from Texas lignite-fired utility boilers: a literature survey. Final report.** Smith, R.L. (Raba-Kistner Consultants, Inc., San Antonio, TX (USA)). Jul 1981. 73p. NTIS, PC A04/MF A01. Order Number DE83900794.

A literature survey was conducted in order to determine the amount of information available to the public concerning the impact of the Resource Conservation and Recovery Act of 1976 (RCRA) on the use or disposal of solid wastes from Texas lignite-fired utility boilers. The utility power plants of ALCOA, Big Brown, Martin Lake, Monticello and San Miguel are the only facilities currently using Texas lignite as fuel. RCRA is a comprehensive federal law which provides for the management of hazardous waste from generation to ultimate disposal. Utility solid wastes such as fly ash and flue gas desulfurization (FGD) sludge are currently classified as excluded wastes (wastes exempt from hazardous classification) pending further information regarding these high-volume, low risk wastes. RCRA also provides for the increased need of recovered materials in Subtitle F - Federal Procurement. The lignite deposits of Texas occur in belts that stretch diagonally across the state from Laredo to Texarkana. The sulfur content and Btu value of Texas lignite combined requires that sulfur scrubbers be installed on new power plant units. The utility solid wastes occur in large quantities and leachate from some of these wastes contained detectable amounts of chromium and selenium. However, the concentration of these elements in the leachate was not sufficient to classify any of the utility wastes in this study as hazardous per current RCRA guidelines. In general, fly ash and FGD sludge are classified as Class II wastes and disposed of in an environmentally acceptable manner. Considerable amounts of bottom ash and fly ash are utilized but, thus far, FGD sludge has been landfilled, usually in combination with fly ash.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 11599, 11600, 11682, 11730, 12270, 12468, 13060

11688 (DOE/ET/10159—T18, pp 361-375) **Environmental data requirements and analysis for development of peat program.** Carstea, D. (UOP Inc./System Development Corp., McLean, VA). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

One of the major research and development areas of the Federal Peat Program includes the preparation of environmental impact assessments. Under phase I potential environmental impacts were identified with respect to: water quality and quantity; air quality; terrestrial and aquatic biological systems; health and safety; and regulatory and institutional barriers. Under phase II an environmental data base will be developed and evaluated, and environmental impact assessments will be prepared for each phase of the peat program in each of the states where a Department of Energy program is active, as well as a programmatic environemtal assessment. A strategy for data collection and assessment is outlined, and the types of data are described. Selected examples of peat development phases that will need to be addressed in the environmental assessments are discussed. (CKK)

11689 (DOE/ET/10159—T18, pp 377-387) **Socioeconomic issues associated with the use of peat as an energy resource.** Harner, D.D. (Radian Corp., Austin, TX). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

Since the Peat Program of the US Department of Energy is a significant federal action, a programmatic Environmental Impact Statement (EIS) that considers both the environmental and socioeconomic impacts is necessary. Guidelines dictate a scoping phase at the beginning to give proper direction to the EIS. This phase has been completed for the socioeconomic impacts of peat technology. This paper summarizes the results of the Phase I report, and lists the ten issues identified as critical to the assessment. These socioeconomic issues are very similar to those related to surface mining of coal and the construction and operation of power plants, so that many of the growth management techniques designed to deal with coal issues may be transferable to peat developments. (CKK)

11690 (DOE/ET/10159—T25, pp 385-396) **Evaluation of environmental issues on the use of peat as an energy source.** Walters, A.; Richardson, S.; Irons, J. (UOP Inc./System Development Corporation, McLean, VA). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Environmental concerns about the use of peat can be divided into those related to the peat resource development/reclamation phase and those related to the energy processing phase. Our analyses indicate that the majority of environmental impacts will occur during the resource development/reclamation phase. The environmental issues and concerns are so broad that they have material effects on the other issues. The initial step in our assessment of environmental concerns was to prepare a brief for each environmental issue identified containing descriptions of the potential environmental effects produced; legislative or institutional requirements to be met; public concerns the issue could be expected to arouse in environmental groups; environmental goals to be met in resolving the issue; and action or data requirements necessary for issue analysis and assessment. Data secured and reviewed from the ten major peat resource states included preliminary knowledge on the extent and ownership of their peat resources, energy development attitudes, environmental concerns, alternative energy programs, and other environmental factors affecting peat development. Because of the large land requirements, the effects on the air, water, and terrestrial environment increase in severity and concern. Thus, the use of these peatlands is considered to be the most critical environmental constraint on implementing peat energy development. Our review indicates that state environmental regulations concerning peatlands (or wetlands) vary considerably from state to state, from very strict, as in New York, to only slightly constraining, as in Alaska. In all states, however, procedures for floodplain or wetlands development would be constrained. The most sensitive environmental areas are the terrestrial and aquatic ecosystems and water quality.

11691 **(DOE/PC/42681—T1) Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report.** (Hittman Associates, Inc., Columbia, MD (USA)). Apr 1982. Contract AC22-81PC42681. 57p. NTIS, PC A04/MF A01. Order Number DE83005476.

Portions of document are illegible.

The objectives of this project were to physically and chemically characterize soil samples contaminated with SRC-II liquids and to estimate the potential leachate composition resulting from the interaction of SRC-II, native soil and surface water. Physical characterization of the soil samples included analysis for pH, cation exchange capacity, and loss on ignition. Chemical characterization of the simulated rainwater leachates included analysis for total organics (TCO), carboxylic acids, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PNAs), organic contaminants by gas chromatograph/mass spectrometry and gravimetric determinations. The results of the chemical analysis of the leachates from the soil samples show that the majority of the spill components are located in the 6 to 18 foot region. Of the compounds identified, phenolic materials are the most abundant, with the remaining compounds being an order of magnitude or less in concentration. No PNAs with molecular weights over 230, PCBs, or carboxylic acids were detected. Geohydrologic studies show the spill-contaminated soil to be porous. The water table at the spill site is 32 feet below the surface. The ground water flows away from the plant and toward a nearby lake and Puget Sound. This spill is of little danger to human health, but the nearby lakes should be monitored for phenolic levels. 8 figures, 11 tables. (ATT)

11692 **(NP—3901078) Geochemistry of leachates from selected coal mining and combustion wastes. Project completion report, July 1977-September 1979.** Kopsick, D.A.; Angino, E.E. (Kansas Water Resources Research Inst., Manhattan (USA)). Jun 1981. 119p. Kansas State Water Resources Research Inst., Manhattan.

During the mining of coal, large amounts of inorganic material (gob) are removed with the coal. After cleaning of the coal, this waste is deposited adjacent to the mined area. One of these gob piles, located in Barton County, Missouri, is evaluated as to chemi-

cal composition of the waste, leaching characteristics of the waste and mineralogy of secondary minerals deposited at the pile. This waste material is enriched in Pb, Zn, Cd and Cu, relative to the abundances of these elements in average shales. Leachate from this material shows elevated concentrations of Zn and Cd. After twenty-five years of weathering, this gob is still producing leachate with high concentrations of Cd, Mn, Cu, Zn and Fe. Two types of coal-combustion wastes, fly ash and bottom ash, from five coal-producing provinces of the United States are discussed in relation to Ca, Mg, Na, K, Mn, Fe, Cu, Zn and Pb concentrations in the whole sample and in the leachate generated from these ashes. Fly ash from northeast-Missouri coal yields a leachate enriched in Pb, Zn, Cu, Fe, Mn and Cd, relative to other leachates, which is indicative of mineralization from nearby lead-zinc deposits. Leachates from two Wyoming fly ashes and bottom ashes exhibit low trace-metal concentrations and high Ca, Mg, Na and K concentrations. Intermediate between these two samples are the compositions of leachates generated from the ashes of eastern-Kentucky and southern-Illinois coals. An evaluation of geology, hydrogeology, soil chemistry, and groundwater chemistry at an ash-disposal site of a coal-fired power plant showed elevated concentrations of Ca, Mg and Na + K in the leachate of the coal ash relative to native groundwater. Only trace amounts of Mn, Fe, Cu, Zn are present in the ash leachate and no degradation of the local groundwater quality is predicted for this site.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 11600, 11735, 11773

11093 (DOE/ET/10159—T18, pp 1-8) **State resource estimation: Alaska.** Huck, R.W. (NORTEC, Anchorage, AK); Markle, D. 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

The objective of this study was to make first estimations of fuel grade peat amounts and locations in Alaska. The US Department of Energy has defined fuel grade peat as having a heating value of at least 8300 Btu/lb, occurring in continuous bogs of 80 acres or more, and having an average depth of 5 feet or more. Alaska redefined this physical criteria to continuous bogs of 320 acres, and added a two-part economic criterion as well: overland distance to the use point could not exceed 30 miles; and for major use potentials, the harvest site was to be located within 5 miles of a major transportation artery. Because of the vastness of the area to be surveyed, the remoteness, the permafrost, precipitation levels, and temperature ranges, the survey team studied a region of 100 mile radius around Anchorage in detail, preselected specific remote areas based on literature data for detailed survey work, and developed a predictive model to assess the probable magnitude of fuel peat elsewhere in Alaska. It is estimated that out of the 107 million acres of peat in Alaska, 47 million acres meet the physical criteria for fuel peat. Only 5.5 million acres will meet both the physical and economic criteria. (CKK)

11094 (DOE/ET/10159—T18, pp 9-27) **State resource estimation: Maine.** Davis, J.; (State Office of Energy Resources, Augusta, ME); Anderson, W.; Cameron, C. 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

The Maine Office of Energy Resources and the US Department of Energy are cooperating in a joint program to determine the amount and location of fuel grade peat in Maine that can be harvested and used in an environmentally acceptable manner. Because other researchers had done surveys, the first task undertaken was to assess the existing data and select priority peat areas to be surveyed. Fifty-seven such areas were identified in the northeastern counties of Maine. Approximately 45 million tons of air-dried commercial quality peat with low sulfur and high hydrogen components and having calorific values ranging from 8600 to 10,500 Btu/lb exist in these 57 surveyed areas. Final peat distribution maps for Aroostook, Penobscot, Hancock, and Washington Counties have been prepared and include data on location, physiographic form, aerial extent, and potential resources of the peat deposits. Individual distribution and thickness maps also have been prepared for specific deposits. Work is in progress on the northwestern counties where 36 deposits have been surveyed and preliminary mapping completed. Future work includes surveying the southern counties and analyzing selected deposits of the northern counties in greater detail. (CKK)

11095 (DOE/ET/10159—T18, pp 37-61) **State resource estimation: Michigan.** Mogk, J.E. (Michigan Energy and Research Association, Detroit); Bourdo, E.A. Jr. 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

The status of the survey to determine the amount and location of fuel grade peat in Michigan is described. Assessment of existing data and selection of priority peat areas to be surveyed has been completed. The statewide peat sampling design and field sampling procedures are described. There are 16 soil-geomorphic provinces recognized in Michigan. Province III was selected as possessing the greatest extent of peat with the highest potential for energy use, and field pilot testing of procedures was done in this area. Preliminary data is presented and indicates significant differences in energy potentials among soil series. Work was begun in two adjacent areas to Province III and general preliminary observations are presented for these areas as well. (CKK)

11096 (DOE/ET/10159—T18, pp 63-77) **State resource estimation: Minnesota.** Asmussen, D. (Minnesota Dept. of Natural Resources, St. Paul); Malterer, T.J. 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

This paper describes the guidelines under which a peat survey is being undertaken, the general progress, and the preliminary results. Minnesota had funded a peat estimation project in 1976 and methodologies had been developed, equipment procured, and approximately 550,000 acres of peat had been surveyed and reported upon prior to the US Department of Energy's funding of a 1.3 million acre peat survey in 1979. Since the original survey called for reconnaissance methods only, some high priority areas were investigated again and peat samples taken for laboratory analysis. Distribution and thickness maps and quality maps are completed for Koochiching County and will soon be ready for Aitkin County. Koochiching County was found to have 1.1 million acres of fuel grade peat. (CKK)

11097 (DOE/ET/10159—T18, pp 79-91) **State resource estimation: North Carolina.** Ingram, R.L.; Otte, L.J. (Univ. of North Carolina, Chapel Hill). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

This paper discusses the status of the US Department of Energy survey of peat resources of North Carolina. There are three geologic types of peat: the Pocosin peats; the River Floodplain peats; and the Carolina Bay peats. One of the small pocosin peat deposits was selected to work out procedures and methods for the rest of the survey. The final report is complete on this deposit. The deposit lies in a shallow depression about 7 feet deep at the center and covers 5930 acres. The peat greater than 4 feet thick totals 3.478 million tons of dry peat; the ash content is usually below 5%; the heating value ranges from 9800 to 10,900 Btu/lb; and the nitrogen and sulfur content ranges from 0.9 to 2.0% and 0.2 to 0.3%, respectively. Other larger pocosin peats which were surveyed are the Pamlimarle Peninsula, the Dismal Swamp, and the Croatan Forest. Field work is almost complete in these areas. Only limited work has been done on the smaller deposits of the River Floodplain and Carolina Bay peats. The problem of the variation of bulk density (dry weight per unit volume) with depth of deposit was discussed in relation to the use of this number in calculating reserves. (CKK)

11098 (DOE/ET/10159—T18, pp 93-133) **State resource estimation: South Carolina.** Cohen, A.D. (Univ. of South Carolina, Columbia); Tisdale, M.; Corvinus, D.; Holmes, M.; Andrejko, M. 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

The status of a survey of the peat areas of South Carolina is reviewed. Detailed analysis is given of the Snuggedy Swamp peat. Snuggedy Swamp contains 17,026 acres of peat with an average heating value of 9853 Btu/lb and containing an average of 8.1% ash, 1.1% nitrogen, and 0.7% sulfur in the top 4 feet of peat. The ash content increases significantly below the 4 foot depth. The deposit contains mostly Sapric and some Hemic peat. Preliminary results only are presented for Colleton, Jasper, Charleston, Berkeley, Horry, and Georgetown Counties. (CKK)

11699 (DOE/ET/10159—T18, pp 153-163) **State resource estimation: Rhode Island.** Boothroyd, J. (Univ. of Rhode Island, Kingston). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

Block Island, located off the Rhode Island coast, was surveyed for its peat resources, which are contained in 200 small separate wetlands on the island. Four wetlands were studied in detail and formed the basis for the resource calculations of the entire island. Cross-sectional diagrams, isopach maps, ash contents, calorific values, and calculated tonnages are given for two of these wetlands, Ambrose and Franklin Swamps. The peat resources for the entire island were calculated to be 190,000 to 380,000 tonnes (air-dried) based on a 1 to 2 meter recovery. (CKK)

11700 (DOE/ET/10159—T25, pp 35-42) **Peat for energy and chemicals research and development program of NRC.** Overend, R.P. (National Research Council of Canada, Ottawa, Ontario). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

It is estimated that between 12 and 15 percent of the surface of Canada is covered with organic soil, muskeg/peat bog or peat. This represents an extraordinary quantity of carbon (the energy content is similar to that in coal and all sand deposits, more than the oil resources and somewhat less than the natural gas resources). However, the mining of peat will result in large scale surface disruption; will conflict in land use with other resources such as forest or agricultural development; and large scale development is unlikely unless this very wet and dilute resource can be transformed into energy-dense conventional end use forms (hydrocarbons). This is unlikely without significant new developments, which may come from biomass research. Local uses as a fuel may develop with technology transfer from countries already using peat. Canadian research programs in peat are outlined briefly. (LTN)

11701 (DOE/ET/10159—T25, pp 325-329) **Overview of state peat resource programs.** Mayer, G.G.; Christianson, L.L. (Grand Forks Energy Tech. Center, ND). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The United States has large deposits of peat with recoverable fuel value roughly estimated at about 538 quads (10^{15} Btu), which is equivalent to 90 billion barrels of oil. Currently, the potential importance of peat as a feedstock for gasification and as a fuel source is being evaluated by the US Department of Energy (DOE). As part of this evaluation, a better estimate of the available US peat reserves is needed. To obtain this information, grants are issued to states to participate in surveys of their state peat reserves. Presently, 14 states have received grants. The objective of the DOE peat survey program is to determine the amount and location of fuel-grade peat in the US that may be harvested in an environmentally acceptable manner. The United States has large areas of organic soils including peat deposits in Alaska, in the northern states including Minnesota, Wisconsin and Michigan, on the east coast from Maine to Florida, and on the Gulf coast. The approximate locations of most major US peat reserves are indicated on the map in Figure 1. The 14 states which are currently participating in the DOE peat program are outlined on the map. These states include Alaska, Maine, Michigan, Minnesota, North Carolina and South Carolina with survey grants initiated in 1979, and Georgia, Florida, Louisiana, Massachusetts, New York, Rhode Island, Alabama, and Wisconsin with grants initiated in 1980 and 1981. A recent analysis in 1976 estimated the peat reserves in the contiguous states at 37.8 billion tons (dry basis).

11702 (DOE/ET/10159—T25, pp 332-333) **Alabama peat resources project.** Clarke, O. (Geological Survey of Alabama, University). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Geological Survey of Alabama under DOE sponsorship is conducting peat resource estimation in the State of Alabama. All of the known peat deposits that have been found in Alabama are located in Mobile and Baldwin Counties. Based on preliminary data compiled through April 16, 1982, approximately 8,000,000 tons of dry peat resource have been estimated. This estimate is based on relatively few drill holes, and further exploration is in progress. Work on the 1981 to 1982 effort is about 40 percent complete to date.

11703 (DOE/ET/10159—T25, pp 332) **Alaska peat resource estimate.** Rawlinson, S. (Alaska Geological Survey, College). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Alaska has a total area of approximately 365 million acres, much of which includes peat deposits. Estimates of potential fuel-grade peat in the state have ranged from 27 million acres to over 100 million acres. The US Department of Energy (DOE) (1979) estimated Alaska to include 27 million acres of unfrozen peat representing 741 quads of energy, assuming peat deposits have an average depth of 7 ft, the moisture content of the peat when utilized is 35 percent, the peat has a heating value of 6000 Btu/lb and a bulk density of 15 lb/ft. Rawlinson and Hardy of Alaska Division of Geological and Geophysical Surveys (DGGS) indicate, in 1982, the total area of peatlands in Alaska is equal to approximately 25 million acres, of which 5 million acres are unfrozen and contain deposits at least 5 ft deep. They estimate unfrozen peat deposits greater than 5 ft in thickness in Alaska to have an energy value of approximately 63 quads, assuming zero moisture and ash and a heating value of 8300 Btu/lb. They speculate that if frozen peat deposits contain the same ratio of peat at least 5 ft in thickness to total peat as do unfrozen peat deposits, the total area of peat at least 5 ft in thickness equals approximately 14 million acres, which represents approximately 180 quads of energy using the assumptions as before.

11704 (DOE/ET/10159—T25, pp 334-335) **Florida peat resource assessment project.** Griffin, G.M.; Wieland, C.C. (Univ. of Florida, Gainesville). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Florida's fuel-grade peat deposits are being mapped and resources calculated as part of the overall Peat Project of the US Department of Energy. Figure 2 is a composite indicating the major prospective areas identified for the state as a whole. In general, there are 5 types of deposits: (1) the huge, poorly drained, interior marshes of the Northern Everglades of Palm Beach County; (2) moderate size marshes adjacent to some large lakes, such as Lake Apopka in Lake and Orange Counties; (3) the extensive upper St. Johns River marshes in Indiana River and Brevard Counties; (4) many small marshes, prairies, and swamps representing filled lake basins, such as the Florahome district of Putnam County; and (5) coastal marshes, as in Monroe County. The fuel grade peat resources of the Northern Everglades is now estimated on a moisture free basis to be 340 million tons and for the state as a whole, 763 million tons (14×10^{15} Btu). Thus, the surveyed peat represents approximately 44% of the total for the state. To map the remainder of Florida would probably require an additional 2 to 3 years because the rest of the deposits will be much smaller.

11705 (DOE/ET/10159—T25, pp 334) **Peat resource estimation in Georgia.** Didocha, R.J. (Georgia Inst. of Tech., Atlanta). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The state of Georgia has an estimated 1.2 million acres of peat deposits of which none is presently being utilized for energy production. Quantification of the tonnage and fuel content of these peat deposits has never been attempted on a statewide basis. While some data on specific regions has been accumulated in conjunction

with other research, for the most part there is no data base for this program.

11706 (DOE/ET/10159—T25, pp 336-337) **Louisiana peat resources assessment.** Koster, E.C. (Dept. of Natural Resources, Baton Rouge, LA). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The Louisiana Geological Survey (LGS) has been investigating peat distribution in South Louisiana. The objectives of this project are to map mineable fuel-grade deposits and evaluate their qualitative and quantitative properties. In 1979 DOE estimated Louisiana's reserves at 4.1 billion tons. The ASTM defines peat as containing more than 75% organic matter. Very little peat meeting this specification has been found in Louisiana. Most organic deposits are fibric to hemic and rarely contain more than the required 75% organic matter. Selection of four prospect-areas for more detailed study was determined by a literature-based resource assessment (Kress, 1980). Most of these prospects are located in interdistributary basins formed by cyclic deltaic sedimentation of the Holocene Mississippi River. Outline of a prospect is based on natural boundaries where possible; however, since virtually all of South Louisiana can be qualified as a peat resource area, these boundaries are in places arbitrary. Peat deposits in Louisiana are basically of two different origins: blanket peats and interdistributary peats. LGS expects to finish all the necessary fieldwork for the four prospect areas during the coming summer. In that case, the original prospect assessment will be completed by September, 1982.

11707 (DOE/ET/10159—T25, pp 336) **Peat resource definition and utilization in Massachusetts.** Sutliff, L. 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

All major tasks have been completed for the current phase of the peat resource program in the Commonwealth of Massachusetts. The principal areas of concentration were those bogs that met the criteria set forth by DOE. Most of the mapping has been completed and samples have been obtained and sent to Grand Forks for analysis. Based on our original assessment and prioritization of the four areas into which the state has been divided, we have identified 180 potential bog sites totaling 171,316 acres averaging approximately 952 acres per site. If the average depths of peat hold up at 7.6 feet, this would translate into a total of 260,467,200 dried tons of peat for the Commonwealth. The most recent field work tends to reinforce the original assessments.

11708 (DOE/ET/10159—T25, pp 338-339) **Maine peat resource evaluation program.** Cameron, C.C. (USGS National Center, Reston, VA); Lepage, C.A.; Anderson, W.A.; Davis, J. 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Since 1909, nearly 500 Maine peat deposits have been surveyed in some detail for their economic potential. Several earlier investigations were incomplete, and estimates of fuel grade peat or areal extent were sometimes not made. In addition, complete laboratory analyses were not performed for most of the earlier surveys. The second year of the Maine Peat Resource Evaluation Program, which is funded by the US Department of Energy to assess the fuel potential of Maine's peat deposits, was completed in 1980. Fifty-six peat deposits in Aroostook, Piscataquis, Somerset, Kennebec and Waldo Counties have been investigated. The deposits range in size from 44 to 1344 acres and contain from 50,000 to 3,204,800 short tons air-dried peat. The total resources of commercial-quality peat are estimated to be 23,908,000 short tons air-dried peat occupying 14,262 acres. Virtually all of the deposits studied may be classed as reedsedge (hemic) and moss (fibric) peat. To date, a total of 44,340 acres in 163 deposits containing 83,757,000 short tons of air-dried peat has been surveyed under the Maine Peat Resource Evaluation Program.

11709 (DOE/ET/10159—T25, pp 338, 340) **Peat resource estimate in Michigan.** Mogk, J.E. (Michigan Energy & Research Association, Detroit). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The first approximation of peat resources for the Lower Peninsula of Michigan has been carried out. Work on the Upper Peninsula is currently in progress. Four to five million acres of peat resource were reported in the Peat Prospectus based on previous work done in tabulating the acreages of organic soils. This estimation is being revised. The land areas and peat acreages from non-photo base and photo base soil surveys for the ten soil-geomorphic provinces in the Lower Peninsula of Michigan resulted in a grand total of 1,728,497 acres, representing a first approximation of the fuel-grade peat resources in the peninsula. Approximately one-half of the Upper Peninsula in Michigan has been intensively sampled to estimate the quantity, quality, and location of fuel-grade peat. Total peat acreage within the 80+ acres per section size classes have been completely tabulated for the counties within the five soil geomorphic provinces in the Upper Peninsula. Data from the pilot plant study Btu analyses and from samples collected under the subsequent improved sampling plan reveal that the majority of the peat samples analyzed meet the DOE specified 8000 Btu/lb requirement. A total of 50 samples was processed and 39 of these (78%) had energy values greater than 8000 Btu/lb (range 8004 to 10,146 Btu/lb). Currently, 540 peat samples collected during summer of 1981 have been sent to the Grand Forks Laboratory for analysis.

11710 (DOE/ET/10159—T25, pp 340-341) **Status of the Minnesota peat inventory project (April, 1982).** Olsen, D. (Minnesota DNR, St. Paul). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

In 1976, the Minnesota Peat Inventory Project (MPIP), funded by the State Legislature and the Legislative Commission on Minnesota Resources, began the survey of peat deposits that have potential for energy and horticultural use. In 1979 the State of Minnesota was awarded a grant by DOE, which was subsequently amended to include partial funding by the Gas Research Institute, to survey Minnesota's peat deposits to obtain an estimate of the state's fuel-peat reserves. Survey teams have completed the survey of approximately one-half of Minnesota's peatlands. Estimates of peatland in Minnesota range from about six million to seven million acres, which is about 12 percent of the state's total area. Peat deposits are found throughout the state, except in the extreme southwest and southeast. The large, contiguous peatlands occur in the southern half of the state. The focus of the MPIP's work is an eight county area of northern Minnesota that contains approximately 4 million acres of peatland. This region is (1) the location of three large peatland areas (peat deposits formed by the paludification of glacial lake plains), and (2) an area in which the majority of peatlands is available for state leasing. Many smaller peat deposits occur in other regions, but most of these are currently being administered for a specific use, are in private ownership, or are being used for agriculture. It is estimated that the energy potential for all peatlands in the state meeting the DOE criteria for fuel-grade peat is approximately 37 quads of energy or approximately 50 percent of the state's total fuel-peat potential.

11711 (DOE/ET/10159—T25, pp 342) **Peat resource assessment for the State of New York.** Peterson, J.M. (NYSERDA, Albany, NY). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The New York State Energy Research and Development Authority initiated a 12 month cofunded investigation of the peat resource indigenous to the state. A total of 1000 wetlands were identified, with 235 peatland areas over 100 acres mapped through aerial photograph interpretation. A detailed field survey was conducted on 6 bogs and ground truthing on another 23. Approximately 346 sites were drilled to check thickness, peat type, and degree of humification along 25 miles of survey line. Another 79 sites were drilled on the 23 peatlands checked during the ground truthing program. Total area surveyed was 6684 acres with 5737 acres detailed. The number of peatlands mapped totaled 146,000 acres. Excluded from this are those bogs less than 100 acres in size and those, of any size, contained in parks and wildlife preserves. Volume estimate is 1.1 billion cubic yards, equivalent to approximately 104 million tons of peat on a dry weight basis. These figures are conserv-

ative and will be finalized as soon as all of the laboratory analyses are available. Phase 2 of the New York Peat Program will be formulated to address the environmental issues. A site specific environmental impact study will be prepared.

11712 (DOE/ET/10159—T25, pp 342-344) **Peat resources of North Carolina.** Ingram, R.L. (Univ. of North Carolina, Chapel Hill). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

With support beginning in April 1979 from the North Carolina Energy Institute and in September 1979 from the US Department of Energy, a survey is being made to determine the location, thickness, quantity and quality of fuel-grade peat in North Carolina. Peat with less than 25% ash and a heating value greater than 8000 Btu/lb is considered to be fuel grade. Peat deposits of North Carolina occur in three geologic settings and represent accumulations of vegetation in (1) coastal swamps or pocosins, (2) river floodplains, and (3) Carolina Bays - elliptical depressions of unknown origin. Most North Carolina peat is a black, fine grained, highly decomposed hemic to sapric peat. A brown, decomposed fibrous peat is sometimes found but is usually restricted to infilled channels. Stumps and logs of white cedar and cypress are common. Typical peats of the coastal swamps and the Carolina Bays are low in ash (less than 10%), low in sulfur (median of 0.2%), and have high heating values (median of 10,000 Btu/lb). Preliminary estimates indicate that North Carolina has about 1100 sq. mi. (0.7 million acres) of peatland containing about 600 million tons of moisture-free peat or about 1 billion tons of 35% moisture peat.

11713 (DOE/ET/10159—T25, pp 344-345) **Peat resource estimation in Rhode Island.** Peters, C. (Univ. of Rhode Island, Kingston). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Twelve of the 291 freshwater wetlands in Rhode Island larger than 10 hectares (ha) have been investigated for peat resource estimation. The 12 wetlands are 25 to 685 ha in size and comprise approximately 20% of Rhode Island's freshwater wetland area. The largest freshwater wetland in the state, Great Swamp, covers 920 ha but is excluded from peat resource estimation because of its value as a State Management Area for wildlife and waterfowl. Isopach maps delineating fuel-grade peat exceeding 1.5 meters (5 ft) in thickness for Chapman and Indian Cedar Swamps have been completed. Chapman Swamp contains 944,220 moisture-free (MF) tons (843,050 tons) and Indian Cedar Swamp contains 1,000,270 MF tons (893,100 tons). Peat quality maps and the fuel-grade peat resource of the other 10 wetlands will be completed when proximate, ultimate, and calorific analyses are received from Grand Forks Energy Technology Center. A best first guess estimate for the fuel-grade peat resource of Rhode Island is 28,246,400 MF tons (25,220,000 actual tons). This estimate assumes that every freshwater wetland in the state exceeding 10 ha (10,682 ha, which excludes Great Swamp) contains 1.5 meters of fuel-grade peat.

11714 (DOE/ET/10159—T25, pp 344, 346-347) **Peat resource estimation in South Carolina.** Vigerstad, T.J.; Cohen, A.D. 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Figure 8 shows the approximate locations of potential major peat deposits in South Carolina and also the status of the field survey program. The Combahee Swamp and the Snuggedy Swamp were discussed in previous reports. Since then about 200 additional samples from about 50 new sites adjacent to and within the main deposit of the Snuggedy Swamp were obtained. These samples are presently being analyzed for ash, moisture, organic content, fiber, and bulk density. Also, a computer-assisted isopach map showing peat thickness in the Snuggedy Swamp is undergoing revision due to collection of new data.

11715 (DOE/ET/10159—T25, pp 347-349) **Peat resource assessment in Wisconsin.** Madison, F.W.; Evans, T.J.; Lippelt, I.D. 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

With funding provided by a grant from the US Department of Energy (DOE), the Wisconsin Geological and Natural History Survey, in cooperation with the Wisconsin Department of Natural Resources (DNR) and the University of Wisconsin Soil Science Department, began an assessment of peat resources in Wisconsin. The intent of this project is to inventory and assess peat deposits in the State of Wisconsin and to determine their fuel potential. After consultation with Pleistocene geologists and soil scientists of the University of Wisconsin, seven geomorphic provinces were delineated in Wisconsin. It is anticipated that the organic soils grouped together within a given geomorphic province should have similar properties. An attempt will be made to characterize peat occurrences within each province, so that depth, Btu, and ash content values can be extrapolated to unsampled peat areas. An existing list of acreages of organic soils in Wisconsin, which was prepared by many different researchers, has been updated. When combined with depth and other information obtained during the field season, it will be used to calculate the volume of fuel-grade peat present in Wisconsin.

11716 **(DOE/ET/12548—13) Advanced Coal-Extraction-Systems Project: report of activities for fiscal year 1980-1981.** Dutzi, E.J. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Mar 1982. Contract AI01-76ET12548. 56p. (JPL-PUB—82-31). NTIS, PC A04/MF A01. Order Number DE83005137.

The Advanced Coal Extraction Systems Project completed several major accomplishments in the definition of target resources, definition of conceptual design requirements for Central Appalachia coals, and initiation of the conceptual design effort. Geologically and economically significant resources were characterized, resulting in recommendations for additional target resources; conceptual design requirements for Central Appalachia coals in the areas of production cost, safety, health, environmental impact, and coal conservation were formulated; and strategies for internal and external design efforts were defined. In addition, an in-depth health and safety evaluation of a modified tunnel borer design for coal mining was completed. At the end of fiscal year 1980-1981, the project was prepared to begin evolution and evaluation of conceptual designs for advanced coal mining systems. The selection of Central Appalachia as the target region automatically imposes certain restrictions and constraints, pertinent to the geology, geography, and other aspects of the operating environment. Requirements imposed by the target resource are summarized. Figure 2-1 presents an overview of the relationship between the conceptual design requirements and the constraints imposed by the Central Appalachian target resource.

11717 **(DOE/ET/12548—15) Study of the United States coal resources.** Ferm, J.C.; Muthig, P.J. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Sep 1982. Contract AI01-76ET12548. 230p. (JPL-PUB—82-14). NTIS, PC A11/MF A01. Order Number DE83005143.

The objectives of this study were: (1) the identification of geologically significant coal resources for the United States, including Alaska; and (2) the preparation of statistically controlled tonnage estimates for each resource type. Particular emphasis was placed on the identification and description of coals in terms of seam thickness, inclination, depth of cover, discontinuities caused by faulting and igneous intrusion, and occurrence as isolated or multiseam deposits. The national resource was organized into six major coal provinces: the Appalachian Plateau, the Interior Basins, the Gulf Coastal Plain, the Rocky Mountain Basins, the High Plains, and North Alaska. Total coal tonnage for a subarea was estimated from an analysis of the cumulative coal thickness derived from borehole or surface section records and subsequently categorized in terms of seam thickness, dip, overburden, multiseam proportions, coal quality, and tonnage impacted by severe faulting and igneous intrusions. Results indicate an aggregate resource in place of 11.6 trillion tons, of which North Alaska accounts for 3.5 trillion tons of subbituminous and bituminous coal; the Rocky Mountains, 2.2 trillion tons of bituminous and subbituminous deposits; and the Gulf Coast, 3.8 trillion tons of lignites. The Appalachian Plateau and Interior Basins are estimated to contain slightly less than 1 trillion tons each of bituminous coal, and the High Plains slightly more than 0.5 trillion tons of lignite. The Appalachian Plateau and Interior Basins are estimated to contain slightly less than 1 trillion tons each, and the High Plains Province is estimated to contain a bit

more than 0.5 trillion tons. The implications of the results for research on advanced mining systems are discussed. 27 figures, 25 tables.

11718 (GFETC/IC—82/1) **Technology and use of lignite.** Kube, W.R.; Sonreal, E.A.; White, D.M. (comps.). (Department of Energy, Grand Forks, ND (USA). Grand Forks Energy Technology Center). 1981. 802p. (CONF-810658—Vol.1). NTIS, PC A99/MF A01. Order Number DE82015926.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Portions of document are illegible.

The Eleventh Biennial Lignite Symposium was sponsored by the US Department of Energy, the University of North Dakota, and the Texas Energy and Natural Resources Advisory Council. It was held at San Antonio, Texas, June 15-17, 1981. Thirty-nine papers from the proceedings have been entered individually into EDB and ERA and one also into EAPA. (LTN)

11719 (GFETC/IC—82/1, pp 48-53) **Peat conversion and utilization in the United States.** Kopstein, M.J. (Dept. of Energy, Washington, DC). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Resources of peat in the United States are summarized, and the possibilities of its use as an energy source are discussed. Novel dewatering schemes and production of peat coal as beneficiation steps are reviewed. Presently employed harvesting methods are inadequate for large-scale operations and improved procedures must be developed. Reactivity of peat char towards gasification is higher than that of lignite or bituminous coal chars. Hydrogasification of peat exhibits a high selectivity to methane and benzene products. The IGT PEATGAS and the Rockwell short-residence-time hydrogasification processes are described. To avoid dewatering of peat, a biogasification process under development utilizes a two-step process of partial oxidation followed by bacterial action to produce methane and carbon dioxide. Direct and indirect liquefaction processes are also under study. Rigorous environmental assessment must precede commercial development, and the socio-economic implications must also be evaluated. The US Department of Energy's peat development is presented, and the active role of private industry in support of the program and their independent advancement in the peat technology base are considered.

11720 (GFETC/IC—82/1, pp 54-91) **Activities in low-rank coal in the Northern Great Plains.** Rice, R.C.; Pederson, R.J.; Parry, G.W.; Williams, K.L. (Western Energy Co., Billings, MT). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The Northern Great Plains Province (NGPP) is one of seven US coal provinces defined by the US Geological Survey. Encompassing portions of eastern Montana, northeastern Wyoming, western North Dakota, and northwestern South Dakota, the NGPP contains approximately 1940 billion tons of estimated remaining coal resources to a depth of 6000 ft. This represents 49% of the comparable US total. Nearly all of these NGPP resources are lignite and subbituminous ranked coals. Surface mines in NGPP have employed two basic types of unit mining operations to move overburden and extract coal: (1) the truck-shovel-dragline operation; and (2) the truck-shovel operation. Other major pieces of equipment, used with success in other producing areas, have been tested, but those listed sustain the highest productivity and lowest operating costs. To date nearly 100% of NGPP coal mined since the 1960's has been used to generate electricity, but the future potential for other uses is increasing. Plans for the production of synthetic fuels and chemicals from low-rank coal have been announced. These plans include two separate gasification plants, one liquefaction plant, and numerous in-situ gasification operations. Although most of these projects have been in the development stage for several years, none is presently under construction. The major stumbling blocks appear to be: (1) a lack of large amounts of necessary risk capital; and (2) a strict regulatory environment imposed by the State and/or Federal government agencies.

11721 (GFETC/IC—82/1, pp 107-141) **Status of Gulf Coast lignite activity.** White, D.M. (Radian Corp., Austin, TX); Kaiser, W.R.; Groat, C.G. 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Lignite resources of the Gulf Coast region are becoming an important fuel source for electric power generation, industrial processes, and synthetic fuels conversion. Near-surface lignites outcrop in a generalized band extending for over 1000 miles (1600 km) through Texas, Louisiana, Arkansas, Missouri, Kentucky, Tennessee, Mississippi, and Alabama. Total resources for the entire region are currently estimated at 35 billion tons (32 billion tonnes). Area mining using draglines currently is the predominant mining technique, accounting for 93% of the 30 million tons (27 million tonnes) mined in 1980. As thinner, deeper, and more lenticular seams are mined in the future, additional approaches, including the use of bucket-wheel excavators, will be employed. The selection of mining method and equipment will be dictated by mine geometry and production level. The control of ground water is expected to be of increased importance in future mines. Current forecasts lignite-fired generating stations for the region indicate that installed lignite-based capacity will triple during the 1980's to 18,565 megawatts. Additionally, significant interest currently exists in the conversion of lignite to medium Btu gas for use as a fuel or conversion into liquid fuels and organic chemicals and in the direct firing of lignite by industry. Assuming construction of currently announced synfuels plants by 1990 and no further deferrals of electrical generating capacity, 1990 lignite production in the Gulf Coast region would be 150 million tons (136 million tonnes).

11722 (GFETC/IC—82/1, pp 162-188) **Canadian low-rank coals: resources, conversion and utilization.** Lee, G.K.; Brown, T.D.; Waley, H. (Canadian Centre for Mineral and Energy Tech., Ottawa). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Canada's measured resources of lignite and subbituminous coal are conservatively estimated at 3500 and 30,000 megatonnes respectively. Most of the subbituminous coals are located close to the surface in the Alberta plains and are now being mined for about $3.00/tonne. National production of low-rank coals, which totalled about 16 megatonnes in 1980, is expected to escalate to over 100 megatonnes by 2000. About 95% of the present demand is used for electricity generation, but this figure will gradually decrease as emerging conversion and utilization processes for industrial heat and energy mature over the next 20 years. Two major pit-head power projects, one at Hat Creek in British Columbia and one south of James Bay in Ontario are under active study and new generating stations in Alberta, Saskatchewan, and Ontario will increase electricity production from low-rank coal from 4500 MW in 1980 to 5500 MW by 1982. Research, development, and demonstration (RD and D) activities (many of which are being done under shared-cost programs between the federal government, the governments of the producing provinces, and industry) are being rapidly accelerated to reflect the high priority being given the national goals of independence from off-shore oil and the achievement of energy security by 1990. Some activities, now in progress, are listed. Future areas of interest include lignite upgrading to reduce moisture content, in-situ gasification, pressurized, fluidized-bed combustion for advanced electricity cycles, and the use of low-rank coal for the extraction and upgrading of bitumen and heavy oil.

11723 (GFETC/IC—82/1, pp 189-207) **Developments in the use of low-rank coal in Australia.** Higgins, R.S.; Garner, L.J. (State Electricity Commission of Victoria, Richmond). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The low-rank coals of Australia are identified and located. The major resources of subbituminous coal are shown to occur in the same regions as the bituminous coal resources. At present the dominant use for low-rank coals is in electricity generation and the southern states are largely dependent on the brown coal resources and lesser resources of subbituminous coals for electricity. Further developments in electricity generation are certain in several areas

and these are outlined. However, the Australian economy is largely dependent on its primary industries which have a continuing requirement for liquid transport fuels. The brown coals of the Latrobe Valley are being seriously investigated for conversion to liquid fuels and the major projects under consideration are described.

11724 (GFETC/IC—82/1, pp 208-227) **Coal conversion in New Zealand: the South Island lignite programme.** Hooper, R.J.; Watson, D.E. (Ministry of Energy, Wellington, New Zealand). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The recent discovery of as much as 10 billion tonnes of lignite-in-ground in the Southland and Central Otago regions of the South Island of New Zealand had the effect of increasing five-fold New Zealand's known recoverable coal reserves. The impact on the coal industry in New Zealand has been immediate with the lignite deposits seen as a potentially major future energy resource. The nine deposits cover a total area of approximately 19,000 ha, with the Southland deposits lying beneath high valued farmland. In general, the deposits consist of multiple thin seams with major seams averaging between 6 and 16 metres. Typically aggregate seam thicknesses are small with the reserve cut-off point a down-hole over-burden-to-lignite ratios of 7.5:1. Current estimates put the lignite reserves economically recoverable by open-cast mining at around 3000 million tonnes. The major seams are generally at mining depths of between 100 and 300 metres. Almost all the lignite is below water table level with the Southland lignites mostly below sea level. Significant differences in the geotechnical and hydrological properties of the coal measures and associated overburden are likely from one deposit to another. The Liquid Fuels Trust Board has recently embarked on a series of investigations aimed at assessing the potential of these deposits as a feedstock for major energy development. Field investigations are aimed at delineating and characterizing the known major deposits and analyzing and assessing the data. A related study to survey the various technologies for converting coal to liquid fuels is also under way.

11725 (GFETC/IC—82/1, pp 228-252) **Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals.** Malliah, K.T.U. (Bharat Heavy Electricals Ltd., Tiruchirapalli, India). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Nearly 67% of the proven non-coking Indian coal reserves have high inert content - ash plus moisture. Moreover, the coal ash contains over 60% silica and is highly abrasive. Coal resources and their characteristics are presented. Utilization of such low-grade coals (without beneficiation) is reported to be the major cause for lower availability of and high consumption of support fuel oil in steam generating plants. An advanced fuel utilization research complex at BHEL, Tiruchirapalli, accommodates many special purpose test facilities: erosion test rig; solid fuel-burning test facility; 10 t/h prototype atmospheric, fluidized-bed boiler; coal handling, preparation, and transport rig; spray characterization facility; flow modeling laboratory; and fuels laboratory. A solid fuel-burning test facility was used to develop high turndown p.f. burners in an industrial size steam generator. Low calorific coal-gas burners were successfully adapted for all modes of oiler operation obviating the need of oil burning in the boilers. A techno-economic study in the Indian context on the use of beneficiated coal in steam generators to minimize the problems caused by high inerts was completed. BHEL formulated a plan to develop fluidized-bed combustion technology for burning low-rank coals, washery middlings and rejects, and has successfully commercialized steam generators up to 45 tons of steam per hour. BHEL is also working on the development of a pressurized, fixed-bed gasifier and a fluidized-bed gasifier. A coal-based, combined-cycle demonstration plant of 6.0 MWe is in an advanced stage of implementation. Also, an MHD pilot plant is coming up at BHEL, Tiruchirapalli.

11726 (GFETC/IC—82/1, pp 321-335) **Policy and planning for the development of deep basin lignite on the Gulf Coast.** Rao, C.D. (Texas Energy and Natural Resources Advisory Council, San Antonio); Hoskins, E.R.; van Rensburg, W.C.J. 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Deep-basin lignite resources of Texas are a potentially vast source of energy both in the medium term and especially in the long term when most of the near-surface lignite resources will have been consumed or committed for power generation and synthetic fuels production. For the recovery of deep-basin lignite, in-situ gasification technology seems to offer several advantages in the Texas conditions with the highly industrialized Gulf Coast region providing ready markets. Texas industry and universities have been conducting active research and development work on in-situ gasification of Texas lignite. Present knowledge of the nature, magnitude, occurrences, and hydrology of the deep-basin lignite is very limited. Further R and D work will be required to characterize the resource, determine the feasibility of the technology under different conditions, gather more extensive data on environmental effects with its regulatory implications, and to stimulate a more widespread commercial interest. Texas Energy and Natural Resources Advisory Council and the 67th Texas Legislature have recognized this need and its importance, and have approved in concept a multi-year, phased research and development program involving active industrial and federal participation. This program provides for expenditure of state funds (to be appropriated separately) with a higher initial state share for the basic research and resource characterization phases and with a stagewise reduction in the state share until the commercial application of the technology is demonstrated. The characterization of the deep-basin lignite is also required for other possible methods of exploitation, such as deep surface mining, and conventional or unconventional underground mining methods.

0120 Mining

REFER ALSO TO CITATION(S) 11690, 11716, 11721, 11782

11727 (DOE/ET/10159—T25, pp 43-54) **Comprehensive use of peat in the USSR.** Mankinen, G.W. (Montreal Engineering Co., Ltd., Toronto, Ontario); Gelfer, B. 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The first attempts to mine peat in old Russia were sanctioned by Peter the Great in 1696. Many of the techniques were borrowed from the Dutch. The methods used involved hard, physical labor (the peat was manually cut). The major factor accelerating the development of the peat industry after the 1920's was the substitution of manual operations with emerging machinery. The period 1920 to 1930 constituted the beginning of the utilization of peat coke as a fuel for the metallurgical industry. The manufacture of peat insulating materials, such as insulating board, began about 1929. About 1935 to 1940 the gasification of peat, peat briquette manufacturing, and the construction of plants to artificially dry peat, and also chemical plants, were started. Particularly significant progress was made as the manufacture of insulation materials for the construction industry. At the same time, the use of peat in agriculture and in farm industry started to grow. Since 1950, peat collecting machines, stockpiling machines, ditchers and stumper machines have been actively developed and permitted peat production to rise in 50 million tonnes annually by 1955, and to eliminate almost all manual work in the essential operations. In 1980, peat production was about 80 million tonnes. Non-fuel products began to count for more and more in the peat processing industry. The agricultural applications of peat, substantially composed of the biochemical and agrochemical aspects, increased. Fertilizers, wax, coke and peat by-products were produced in quantity. Currently, the USSR peat industry is not limited to the mining of local fuel resources, but is a complex network of branch industries and research facilities for the modern processing and treatment of peat.

11728 (DOE/ET/10159—T25, pp 55-86) **Conceptual designs for peat production systems.** Ludlow, J.; De Bakker, P. (Foster-Miller Associates, Inc., Waltham, MA). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Six novel systems have been compared with two conventional peat production systems and estimates obtained for requirements in terms of resource area, manpower and equipment. Projected annual production costs have been calculated using assumptions which yield a figure which represents the core cost of a production operation. Each of the determinations has been carried out for three types of climate, represented by that of Florida, Minnesota and Alaska. The methodology and in particular the assumptions underlying the economic analysis will be described in full in the final report. It is appropriate, however, to list a number of tentative conclusions: (a) in terms of economic feasibility the lower bounds of the target costs for dry and wet peat were assumed to be respectively $1.00 and 50 cents per 10^6 Btu (when dried to 50 weight percent. The lowest annual production costs for each category and state are given. There is reason to suppose that in terms of the simple model used, peat can be harvested economically if a suitable method is employed. The costs do not include preproduction, licensing or off-bog transportation but the fact that the core costs are substantially below the costs at which peat is believed to be competitive is grounds for optimism; (b) sod peat harvesting is absent from the above table since it did not appear to be the most competitive system in any of the climates; and (c) the relatively short season for peat production in higher latitudes impacts peat economics by requiring larger ensembles of machines and numbers of operating personnel.

11729 (DOE/ET/10159—T25, pp 131-134) **Testing of sod peat equipment and elucidation of sod dewatering characteristics.** Allen, A.B. (First Colony Farms, Inc., Cresswell, NC). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Available milled and sod peat production equipment was obtained from Finland and the Soviet Union and experimentally operated to evaluate its performance under conditions at First Colony Farms. Additional equipment designed, developed and modified by First Colony engineers was also evaluated. Production rates were established for the various units of equipment under various bog, climatic and seasonal conditions. Drying rates for milled and sod peat were established and related to meteorological data. The technology developed has produced the necessary equipment, procedures and techniques required for a commercial scale peat production operation. The average cost to produce and field-stockpile 2.1 million tons of 30% moisture peat annually using the developed procedures is $10.26 per ton or about $0.74 per million Btu's (1982 dollars). Not included in this amount are provisions for transportation to a plant site, annual real estate taxes and insurance, peat royalties, return on investment and the residual value of land underlying the peat deposits. It should be observed that these data were developed for the specific conditions at the First Colony Farms' experimental site. This peat is highly decomposed and the wood content is higher than much of the peat in other areas of the world. This adds to costs of equipment and operations. However, the climatic conditions for solar drying are favorable, permitting faster drying and longer harvesting seasons. Thus, cautions should be observed in using the average costs summarized here.

11730 (DOE/ET/10159—T25, pp 357-366) **Socioeconomic issues associated with the use of peat as an energy resource.** Harner, D.D. (Radian Corp., Austin, TX). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Utilization of peat as an energy resource will cause socioeconomic issues to emerge, regardless of where it occurs or the size of the development, and while peat utilization is unique in many ways, the socioeconomic issues identified are very similar to those that are related to surface mining of coal and the construction and operation of power plants. Management techniques have been designed to deal with these issues, and many will be transferable to peat developments. Sensible modifications to existing services/facilities can help overcome potential problems and create new industries at the same time. For any specific site program it will be possible to use this report to facilitate the actual EIS process.

11731 (DOE/FE/00080—7) **Longwall data bank. Quarterly project status report, August 28-November 28, 1982 and semiannual report No. 3.** (Bituminous Coal Research, Inc., Monroeville, PA (USA)). Jan 1983. Contract AC01-81FE00080. 43p. NTIS, PC A03/MF A01. Order Number DE83004850.

The objectives of the program are to compile and transfer to the coal industry comprehensive operational data on US longwall installations, and to provide abstracts of domestic and foreign literature related to longwall production, productivity, and dust control published since 1975. During the period of August through November 1982, five updated longwall questionnaires were received from operators and two additional longwalls were added to the questionnaire file. Three requests for information from the Data Bank were received and processed. Data from questionnaires were tabulated and analyzed. Also, relevant coal-mining publications were reviewed for articles on longwall mining. Fifteen abstracts were prepared from selected R and D reports, conference papers, and articles in professional journals. These abstracts are included in Appendix B.

11732 (DOE/FE/14185—T4) **Returning coal waste underground. Phase I: report addendum.** Adam, R.F.J.; Kok, M.; Popovich, J.M. (Ketron, Inc., Pittsburgh, PA (USA)). 3 Sep 1982. Contract AC01-81FE14185. 79p. NTIS, PC A05/MF A01. Order Number DE82021797.

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The technical and economic feasibility of depositing mine waste underground at Millers Cove has been assessed. Advantages of the selected site are: the willingness of the mine management to cooperate; existing conditions at the mine complex; and the structure of the cleaning plant, which will permit picking up the refuse without major alterations. Disadvantages are the absence of gradient in the areas to be mined in the near future and the height of the mined seam, averaging 36 inches to 42 inches. Advantages, however, compensate for the disadvantages. In addition, if returning waste underground can be achieved economically in spite of the disadvantages, the technology will be widely applicable to the mining industry. It appears feasible to return the waste underground at the current price of surface disposal. The feasibility study has been based on current mining operations, the productivity of which is more than satisfactory. The most promising concept is hydraulic backfilling. The coordination of waste disposal and extraction activities does not present any problems with the current mine design which isolates each mine section. Backfilling will be started after completion of the extraction of each section.

11733 (DOE/PC/30205—4) **Power shovel data accumulator and display. Final report, September 1982.** Keller, K.J. (McDonnell Douglas Electronics Co., St. Charles, MO (USA)). Sep 1982. Contract AC22-80PC30205. 90p. NTIS, PC A05/MF A01. Order Number DE83003227.

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The objective of the Power Shovel - Data Accumulator and Display project sponsored by the Department of Energy was to develop a microprocessor-based monitoring system to improve the utilization of loading shovels used in the coal industry. This system monitors the shovel operation, displays performance parameters and maintenance alerts to the operator and provides mine management with a data base and reporting system on shovel production and maintenance. The major components of the system are a Z8002 micro-computer, operator keyboard and display, signal conditioning unit, a radio data link and sensors to monitor the shovel operation. A prototype system was fabricated and laboratory tested prior to being installed on a Bucyrus Erie 295B shovel which is being used to remove overburden in a western coal mine. This report describes the design, installation, testing and evaluation of the system.

11734 (GFETC/IC—82/1, pp 253-314) **Low-rank coal exploitation and utilization in east European countries.** Stefanski, M.J. (Economic Commission for Europe, Geneva, Switzerland); Libicki, J. 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Reserves in seven eastern European countries are approximately 135,660 million metric tons (mt) slightly over half the world's reserve of lignite. In 1979, 630.7 mt of brown coal were mined and used chiefly for power production. Mining is usually by open-cast techniques with reclamation following mining operations. Geology, reserves and resources, mines and operations, reclamation and coal utilization are detailed for the German Democratic Republic, USSR, Czechoslovakia, Poland, Hungary, Bulgaria, and Romania.

11735 (GFETC/IC—82/1, pp 315-320) **Lignite in Europe: use, present and future production.** Weise, H. (Rheinbraun Consulting, USA, Inc., Englewood, CO). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Total lignite deposits in Europe are approximately 184 billion metric tons (mt) of which 106 billion mt are considered economically mineable. Inclusion of the European part of the Soviet Union would add an additional 100 billion mt of resources. Some 483 million mt were mined in 1980, most of which was used to generate electric power. An extensive power distribution network allows for power interchange throughout northern and southern Europe. Lignite is generally surface mined using high-capacity, bucketwheel excavators and belt conveyors. At present, lignite is mined to depths of 300 m at stripping ratios of 3.5:1. In the future, the ratio will reach 6:1. Mining techniques are described. Removal of groundwater and reclamation of mined land are major problems. Future use of lignite for power generation should be curtailed with electric power being obtained for nuclear-fueled stations. The lignite should be reserved for production of synthesis gas, methane, or liquid products.

11736 (GFETC/IC—82/1, pp 395-400) **Past, present, and projected energy sources for electrical generation in Texas.** Nugent, J.E. (Texas Railroad Commission, Austin, TX). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Lignite legal production in Texas reached 30 million tpy in 1980 and is projected to be approximately 50 million tpy by 1985. The price differential between well-head natural gas and lignite has increased in the past and is projected to increase in the future as the price of gas and lignite both increase. Electrical generation in thermal plants is the major use of coal. By 1988, half of the total power generated should be from coal and nuclear sources. Nuclear-generated electricity is estimated at only 8%.

11737 **(MTCH-PR—7-79) Power supplies.** (Mining Technology Clearing House, Tamworth, Staffordshire (UK)). 1979. 51p. NTIS, PC A04/MF A01. Order Number DE83005503.

There are 15 Registers compiled annually from information collected by the MTCH from Member countries. Each Register covers a particular subject area and those for 1979 contain summaries of coal mining R and D projects known to the MTCH that have been active at some time since January 1977. Information sources are primarily government and central R and D agencies. The form of the input data from the different agencies varies, and consistency of presentation has been achieved by summarizing the data in a standard way. Additional information on each project often exists within the MTCH, and this information may be available in response to any queries that the Registers generate. The information on each project usually includes: date of information, serial number, agency name/initials, agency project number, agency project title, brief synopsis of information (objectives, method and progress), project leaders, associated organizations, funding, starting date and expected or actual finish date. This register is devoted to electrical equipment, diesel engines, hydraulic equipment and innovative power devices (liquid nitrogen, hybrid electric vehicles, etc.). (LTN)

11738 **(ORAU—207) Assessment of benefit-cost analysis for coal-extraction R and D.** Baker, J.G.; Stevenson, W. (Oak Ridge Associated Universities, Inc., TN (USA). Manpower Education, Research and Training Div.). Oct 1982. Contract AC05-76OR00033. 38p. NTIS, PC A03/MF A01. Order Number DE83004749.

This report has two purposes: (1) to discuss guidelines for applying traditional benefit-cost analysis to coal extraction R and D based on a literature review; and (2) to present a critique of Benefit-Cost Analysis of the Coal Extraction R and D Program, a study by the Mitre Corporation completed in 1976. The guidelines include the strengths, weaknesses, omissions, and limitations of benefit-cost methods as a means to rank coal extraction R and D, including those characteristics that are common to all benefit-cost studies and those that are uniquely related to coal extraction R and D. Suggestions are made for solutions to problems and limitations of the traditional benefit-cost method, and the usefulness of benefit-cost methods as a means of ranking competing coal R and D programs is assessed.

11739 (SERI/CP—234-1590, pp 313-328) **Production of fuel grade peat at First Colony Farms, Inc.** Allen, A.B. (First Colony Farms, Inc., Creswell, N.C.). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

The surface peat deposits found along the coastal plain in eastern North Carolina contain high quality fuel grade peat that can be used as a feedstock for gasification processes, methanol production, chemical extraction or electric power generation. However, before the peat can be effectively utilized, the high natural moisture content must be reduced and the peat must be harvested and stockpiled. The present peat production program at First Colony Farms is aimed at developing and evaluating various methods of harvesting and stockpiling commercial quantities of high grade fuel peat at or around 30% moisture. This paper discusses the peat production technology developed during First Colony Farm's peat program.

11740 **Ground-water problems in open-pit and underground mines.** Cook, N.G.W. (Univ. of California, Berkeley). *Geological Society of America, Special Paper;* No. 189, 397-405(1982). (CONF-790284—).

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

Ground water constitutes a significant operational problem and potential hazard in open-pit and underground mining. The pressure of ground water in geologic discontinuities adversely affects the safety of height and slope angles of open-pit mines, justifying measures to reduce ground-water pressures in their vicinity. The principal hazard in underground mining and tunneling arises from massive inflows of ground water when the mine unexpectedly intersects large, water-bearing geologic discontinuities; normal inflows are on the order of 2.5 tons of water per ton of rock mined. In tunneling, pilot drilling ahead of the advancing face is used to detect such discontinuities, which can then be sealed by ring drilling and cover grouting. Extensive deformations resulting from large areas of unsupported roof make such grouting ineffective in many mine excavations. Surprisingly few data are available with which to calculate the permeability of rock masses at depth. Two sets of data quoted yielded permeabilities of 0.8×10^{-9} m/s for tunnels, and 1.6×10^{-6} m/s for mined excavations, at a depth of about 1.5 km below surface and before the permeability of the rock mass is enhanced by deformations induced by mining. The difference between these values may be attributed to local reductions in the permeability of the rock mass by the grouting of major discontinuities in tunneling, which is not done ordinarily in mining. Where precautions such as regional dewatering,installation of watertight bulkheads, and adequate spare pumping capacity are not sufficient to cope with potential inflows in mining, the extent of the unsupported roof in mines must be broken by regularly spaced pillars, so that pilot drilling and cover grouting can be done. 7 figures.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 11600, 11603, 11620, 11718, 11729, 11763, 11780, 12849

11741 (CONF-8203103—, pp 26p, Paper 1) **Introduction to coal preparation.** Albrecht, M.C.; Matoney, J.P. (Kaiser Engineers, Inc., Oakland, CA). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

Coal preparation can eliminate or minimize the inherent variability found in run-of-mine coal. The prediction of clean coal yield from any coal at a desired quality level can be performed using partition curves and washability data. The determination of the best cleaning circuit for any coal is based on the desired quality and how the coal separates by gravity. The type of equipment used to clean a coal is more dependent on the gravity at which that coal must be cleaned to produce the desired quality and the economics involved rather than the end use of the clean coal.

11742 (CONF-8203103—, pp 7p, Paper 2) **Benefits of coal preparation.** Wolfe, R.A.; Walia, D.S. (United Coal Co., Bristol, VA). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

The benefits of coal preparation are to both coal producer and the coal user. It enables the coal producer to produce an improved and premium fuel with broad market acceptability. The user benefits from the lower transportation costs through more Btu/ton in the fuel, meeting air quality standards, improved economics and technical performance of boiler, reduced cost and environmental problems related with ash disposal, and lower capital costs of flue gas clean-up equipment.

11743 (CONF-8203103—, pp 22p, Paper 3) **Economics of coal preparation.** Terry, R.L. (Envirotech Coal Services, Beckley, WV). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

This paper presents a general method that can be used to evaluate various coal preparation alternatives based on discounted cash flow investment criteria. Highly efficient coal preparation systems are more expensive to install and to operate than less efficient systems. In many cases, however, systems with high efficiency can be economically justified because of their ability to recover more marketable product from a given raw coal input. A specific example in which four alternative coal processing schemes are evaluated is presented. Compared to the base case, the internal rates-of-return on incremental investments in more efficient preparation equipment range from 60 percent to more than 120 percent.

11744 (CONF-8203103—, pp 16p, Paper 4) **Moving coal by rail.** Lang, D.L. (Association of American Railroads, Washington, DC). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

Railroads today are hauling near-record volumes of coal. Studies indicate that railroads can more than keep up with projected increases - provided they have the necessary financial resources to maintian, improve and expand plant and capacity. Given the relative importance of railroads to coal transportation, it follows that future coal production will be somewhat affected by railroad capacity - both physical an fiscal - to handle coal. Deregulation does seem to be leading to a revitalization of the railroad industry - the very revitalization that will make it possible for railroads to afford to undertake the massive capital improvement programs required to move projected increases in coal production.

11745 (CONF-8203103—, pp 9p, Paper 5) **Transportation of coal by slurry pipelines.** Eatman, G.H. (Slurry Transport Association, Washington, DC). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

The recent surge of interest in coal slurry pipeline technology can be traced to its inherent advantages. It is a system for shipping coal which is efficient and environmentally sound and which will help hold energy costs down. By this method, coal, a solid energy form, can be shipped from mines to users essentially as a liquid. This is accomplished by grinding the coal to a near powder and mixing it with a liquid, usually water. The resulting slurry is then pumped through an underground pipeline, hundreds of miles if that is required, for delivery to one or several points of use and/or to a terminal for continuing shipment by another transport mode, such as, barges or ships - or even truck or rail. Generally speaking, when the slurry arrives at a point of use, the water is removed and the coal is available for burning. Recent breakthroughs have clearly established that some coal-water and some coal-oil-water slurries can be direct fired in boilers constructed to burn number 6 fuel oil.

11746 (CONF-8203103—, pp 6p, Paper 6) **Future coal export demand and its effect on the United States market.** Wynkoop, M.M. (Primary Coal, Inc., New York, NY). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

The industrial consumers throughout the world are in the process of converting their electric and industrial plants to a coal base. This movement has been encouraged by their governments in order to break the effects of the oil cartel. The United States will be called upon to supply a large portion of this steam coal which will have an effect on the price and availability of coal at the mine, transportation and the United States ports. The scope of this market and the ability of the United States industry to meet the future demand is the subject of this address.

11747 (DOE/ET/10159—T18, pp 323-341) **Peat dewatering: solvent extraction.** Paganessi, J.E.; Sishtla, C.I.; Knowlton, T.M.; Punwani, D.V. (Inst. of Gas Tech., Chicago, IL). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

A status report is given of a technical and economic feasibility study of a solvent extraction process for dewatering peat. The process is based on the principle that water becomes more soluble in selected organic solvents as the temperature increases. Wet peat is mixed with a solvent and heated under pressure to prevent the water from vaporizing. The water dissolves in the solvent, and the peat is allowed to settle out at the bottom. The solvent is pumped away and upon cooling, separates into a water-rich layer and solvent-rich layer that is recycled into the process. The peat is mechanically dewatered and pressed. Based upon literature data, ten potential organic solvents were found and these were tested for their peat soaking ability and phase separation ability. The five solvents which performed adequately in these tests were tested for their peat dewatering ability in a bench-scale apparatus (illustrated). Diethyl ketone (DEK) and benzene were the only two which did not react with the peat. These were tested with Minnesota, North Carolina, and Maine peats. Preliminary results show that DEK dewatered all three peats to about 50%, most of the dewatering coming in the phase separation step and only a little in the mechanical dewatering step. Benzene dewatered Minnesota peat to about 30%, but most dewatering came in the mechanical step. Work is still in progress on these solvents and the economic evaluation has yet to be done. (CKK)

11748 (DOE/ET/10159—T18, pp 343-353) **Water retention properties of peat and their modification.** Graves, D.J. (Univ. of Pennsylvania, Philadelphia). 1980. NTIS, PC A18/MF A01.

From 2. technical contractors' conference on peat; Bethesda, MD, USA (16 Oct 1980).

Most processes envisioned for peat utilization as a fuel require the dewatering of peat. This paper briefly describes a study aimed at achieving a basic understanding of the mechanisms of water retention in representative peats (Minnesota, North Carolina, and Maine) so that improved or new water removal methods can be developed. Three forms of bound water are discussed: physically entrapped water by capillary forces; water retained by chemisorption; and water which is part of the basic chemical structure of peat. The capillary pore-retained water is discussed in some detail. (CKK)

11749 (DOE/ET/10159—T25, pp 135-146) **Water retention mechanisms in peat.** Graves, D.J.; Kandebo, S.W. (Univ. of Pennsylvania, Philadelphia). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The irreversible water loss during drying was studied and, as previously mentioned, one study of centrifugal water removal from partially dried peat was carried out. This work was aimed at confirming reports that partially dried peat will not regain its initial water levels even if soaked in excess water for extended periods. A second goal was to see if the pore closure model could explain such irreversibilities. In essence, this model suggests that the reason for irreversible water loss is that the enormous hydrostatic pressures, created by surface tension in pores of micron and sub-micron dimensions actually crush the pores out of existence during evaporative drying. If this view were correct, then freeze drying would prevent pore closure by eliminating the surface tension forces. A consistent observation during centrifugation of peats was that the more highly decomposed samples (from North Carolina) retained more water at a given centrifugal force than did those from Minnesota. Somewhat disappointing was the fact that little if any incremental water loss was evident at centrifugal forces between about 1000 and 10,000 g. If one accepts the pore model as a reasonable and realistic one, this means that there is one population of relatively large pores and that all other pores are so small as to be immeasurable by this technique. Although the exact numbers one assigns to these two groups depend on one's choice of model, approximate valves would be greater than 200 and less than 60 microns, respectively. An example of such data is given in Fig. 2. Other centrifuge experiments conducted with solvents, cellulolytic enzymes, and hydrogen bond breaking salts showed either little effect at all on retained water or an increased solvent retention.

11750 (DOE/ET/10159—T25, pp 375-384) **Peat research and development in Sweden.** Lindstrom, O. (Inst. of Technology, Stockholm, Sweden). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

The Swedish research programs involving peat are described briefly. Instead of wet carbonization they are using a decanter centrifuge and thermal drying before pelletizing. There was considerable discussion after the talk about the relative merits of the two processes and whether they were economic or applicable to different types of peat. They are also interested in liquefaction and gasification, including flash pyrolysis. They are also interested in using peat for iron ore reduction. Because of the environmental effects of burning wood and peat in small systems, they are interested in small scale gasification and combustion systems. (LTN)

11751 (DOE/FE/00103—T1) **Study of hydrocyclone applications to separation processes for coal preparation. Final report.** Bouchillon, C.W. (Mississippi State Univ., Mississippi State (USA)). 1981. Contract FG01-81FE00103. 34p. NTIS, PC A03/MF A01. Order Number DE83004706.

The project objectives were to conduct a literature survey, visit coal cleaning facilities, develop an empirical predictive model and a life cycle cost method - while involving several students in an introduction to coal technology. A computerized literature research of four files was made and the more pertinent references were reviewed and presented. A visit was made to the Paradise, Kentucky coal washing plant of TVA and the coal cleaning activity of PETC-DOE at Pittsburgh, Pennsylvania. An empirical predictive model was developed for hydrocyclones based on one manufacturer's information on flow rates, pressure drops, hydrocyclone geometry, and particle sizes. This was combined with a life cycle economic analysis program to provide additional techniques for proper hydrocyclone selection criteria.

11752 (DOE/MC/14101—1126) **Research and development leading to the preparation of a gravity flow of solids media engineering databook for coal conversion and utilization processes. Phase I. Final technical report.** (Jenike and Johanson, Inc., North Billerica, MA (USA)). Dec 1981. Contract AC21-80MC14101. 287p. NTIS, PC A13/MF A01. Order Number DE83003087.

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The reliable flow of coal at elevated temperatures and/or high gas pressure is a significant problem for most coal conversion and utilization processes. To address this problem the consulting firm of Jenike and Johanson, Inc. (J and J), Billerica, Massachusetts has been awarded a three-year contract to identify parameters and develop the necessary testing equipment, theory, and verification experiments to produce a databook for reliable gravity coal flow. Under the completed Phase I of this five-phase project, a shear tester has been designed, built, and tested for elevated temperatures (up to 1000°F) and high gas pressures (up to 750 psi) using well-established J and J technology. Together with existing testing equipment and techniques this permits the determination of shear strength, wall surface friction, permeability, and compressibility of bulk solids at temperatures and pressures with these ranges.

11753 (DOE/PC/30076—T4) **Project to develop and demonstrate methods to eliminate frozen-coal-handling problems. Final report.** (United Coal Co., Bristol, VA (USA)). Nov 1982. Contract AC22-80PC30076. 40p. NTIS, PC A03/MF A01. Order Number DE83003755.

This paper represents an evaluation of methods of removing frozen coal from railroad hopper cars. The work was based on a careful study of previous methods and examination of innovative methods proposed. It was found that chemical freeze conditioning and side release additives helped for temperatures above 5°F but were of marginal benefit for lower temperatures. Further, the effectiveness varied with the particular material and the amount and method of application, and was not well correlated with the price. An innovative method United Coal liked and continued development at their own expense involved an auger/air cannon system in which the auger penetrated the frozen crust to within 2 to 3 feet of the bottom hopper doors and then an air blast from a tank at 140 to 350 psi freed the coal. This was particularly effective when used in connection with the existing overhead shaker facility. Other methods were also evaluated. Some were too expensive in energy, damaged the cars, or were ineffective (or in some cases dangerous). (LTN)

11754 (DOE/PC/40807—T5) **Flow and design characteristics of the hydrocyclone for the recovery of coal fines. Fifth quarterly report, September 1, 1982-November 30, 1982.** Davis, P.K. (Southern Illinois Univ., Carbondale (USA)). 1982. Contract FG22-81PC40807. 64p. NTIS (US Sales Only). Order Number DE83003860.

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An attachment to the new experimental system has been designed and constructed so that spheres can be injected at the center of the vortex motion inside the hydrocyclone rather than upstream from the tangential inlet. This is accomplished by means of a tube up through device is included in Appendix G. Preliminary data show a significant improvement in the separation ability of the hydrocyclone, the idea being that the light particles do not have to make their way to the center because they are already there. The heavier particles are quickly thrown out radially to the wall by the centrifugal force once they are caught up in the swirling flow. Plots comparing these data to previous data in which the spheres were injected tangentially with the water flow are given in Appenidix G. Another idea for a possible improved design is to have an underflow that discharges tangentially rather than through a centrally located underflow. It has been found that quite often the heavy spheres get trapped in the hydrocyclone and do not report down the cone and out the underflow opening in the apex as desired. A very small plastic hydrocyclone has been constructed and preliminary data indicate that the heavy spheres that do not report to the overflow will indeed exit out a tangential opening in the hydrocyclone. It is anticipated that further research will be done using this concept.

11755 (DOE/PC/42295—T5) **Gravimelt process development. Quarterly technical progress report.** (TRW, Inc., Redondo Beach, CA (USA)). 20 Nov 1982. Contract AC22-81PC42295. 15p. NTIS, PC A02/MF A01. Order Number DE83002234.

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Evaluation of the mod 1 continuous bench-scale reactor was completed. A 3% mass balance error was obtained in the final test series using Pittsburgh and Upper Freeport coals, well within the target 10% maximum. Based on operating experience, a mod 2 design was finalized and installation is nearly complete. This design is expected to overcome problems caused by foaming. Pittsburgh coal, which was found to foam and requires aggressive reaction conditions to clean, was selected for testing in the mod 2 reactor. Laboratory batch data were used to study the variation found within four different Pittsburgh seam coal samples and the effect of particle size. Reactor stirring effects also were studied in support of the mod 2 design.

11756 (GFETC/IC—82/1, pp 490-503) **Operating experience in burning lignite at Coal Creek Station.** Hickok, W.W.; Sullivan, R.A.; Moen, D.E. (Cooperative Power Association, Eden Prairie, MN). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The Coal Creek Station is owned by Cooperative Power Association of Eden Prairie, Minnesota, and United Power Association of Elk River, Minnesota. It consists of two units rated at 500 MW each located 50 miles north-northwest of Bismarck, North Dakota. Unit No. 1 started in 1979 and Unit No. 2 in 1980. This paper discusses: (1) comparison of the predicted lignite analysis and actual as fired lignite analysis in 1980; (2) operation of the lignite-handling system including problems during its first North Dakota winter; (3) problems and corrections with a new model of pulverizers which were the first to go into operation with a capacity of nearly 70 tph each; (4) the fans controlling the balanced draft and their performance; (5) performance of the steam generator, including stack temperatures and modifications, sodium, slagging, and a performance test at 504 to 550 MW; and (6) SO_2 Scrubber operation and maintenance, including some problems in adding fly ash.

11757 **(IS-T—1022) Binderless briquetting of coal powders by an acetone treatment process.** Fields, G.L. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 82p. NTIS, PC A05/MF A01. Order Number DE83004977.

Thesis.

The results of an experimental investigation of a binderless briquetting process are presented. The process involves the use of a solvent treatment step instead of using a conventional binder, and can produce water-resistant briquettes of high durability from high volatile C bituminous coals. The effectiveness of several types of solvents was determined as well as varying conditions of treatment and pressing. Treatment conditions of solvent to coal ratios, contact time, solvent temperature, and coal moisture were studied, as well as pressing conditions of temperature, pressure and coal moisture. The ketones were the most effective of the solvents studied and acetone was given the most attention due to its low cost, recoverability and fast solvent action. The optimum treatment conditions are to treat dry coal powders with acetone on a 1 to 1 weight basis for 60 sec. The acetone can be evaporated off the coal at room temperature or in an oven at 110°C. The acetone may also be removed by leaching with water and recovered through distillation. Wet coal powders can also be treated if the moisture level is kept below 15 to 20%. The optimum pressing conditions were determined for acetone treated powders that were briquetted with a Buehler Specimen Mount laboratory press. The conditions are a pressure of 10,000 to 12,000 psi, a temperature of 150°C, a pressing time of 5 min, and a coal moisture level of less than 5%. Briquettes made from acetone treated coal powders demonstrated superior resistance to water penetration and degradation. The process has potential for scale-up to an industrial size by using a roll-press briquetter.

0140 Combustion

REFER ALSO TO CITATION(S) 11642, 11662, 11678, 11727, 11780, 11961, 12268, 12269, 12283

11758 (CONF-8108141—, pp 257-268) **Electric utility criteria and decisions: coal-oil mixtures, coal-oil-water mixtures and selected advanced coal systems.** Uhrig, R.E. (Florida Power & Light Co., Miami). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

In summary, we have demonstrated the feasibility of burning coal-oil mixtures in a 400 MWe plant designed originally to burn oil. Studies are continuing with plans being made to conduct some tests on coal-water mixture, coal-oil-water mixtures and pulverized coal. There is a common wisdom that if you can burn pulverized coal alone it is by far the most economical route. However, this may be a near-sighted view, not taking into account all the environmental consequences and associated costs. We are continuing this work with the expectation that it will lead to a decision in the next year or two whereby at least some of our large oil burning plants will be converted over to coal or some coal-based liquid fuel.

11759 (CONF-8108141—, pp 318-336) **Tennessee Valley Authority's atmospheric fluidized bed combustion program.** Mayfield, M.J. (Tennessee Valley Authority, Chattanooga). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Based on the technology improvements made in the last year or so, the economics and attractiveness of AFBC have been significantly enhanced. Some of the more significant improvements include boiler designs which provide adequate residence time for reactions in the bed and freeboard area; the use of increased recycle of elutriated fines, and the introduction of secondary air above the bed for 2-stage combustion. With these changes, the calcium to sulfur stoichiometry required for 90-percent sulfur removal has been cut in half. Carbon utilization has been increased to the 98- to 99-percent level required for utility applications and oxides of nitrogen should be in the range of 0.2 pounds per million Btu or less. When completed next year, the 20-MW AFBC pilot plant is expected to confirm the performance capabilities which have been achieved in smaller units and provide the design and information needed to confidently scale-up this technology for use in utility-size AFBC boilers.

11760 (CONF-8203103—, pp 13p, Paper 7) **Commercial availability of coal-oil and coal-water fuels.** Kelly, J.F. (Davy McKee Corp., Cleveland, OH). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

Coal-Oil Mixture (COM) combustion has been characterized as a near term technology which has potential application in existing utility and industrial steam generators, as well as application on several other types of industrial combustors. COM can allow up to approximately 50% substitution of coal (by weight) for fuel oil while the capital expense of the retrofit is much less than that for a total coal conversion. In some cases, total conversion to coal may not be possible. The most recent COM activity began in late 1974 with the initiation of an experimental program by General Motors at their Saginaw facility. In late 1976, ERDA (now the Department of Energy) initiated a coal-oil mixture combustion demonstration program. These programs were primarily directed at the technical issues related to COM use. Through the efforts of these programs, as well as the efforts on the part of several other commercial developers, it has been technically demonstrated that COM can be prepared, stabilized, transported and successfully used as a substitute for fuel oil in existing combustors. Throughout this developmental period, COM economics were continually changing in favor of COM. At the present time, several companies are offering COM on a commercial basis. This paper will address the commercial availability of COM by covering the companies offering the fuel commercially, giving a brief description of their respective preparation technologies and operating COM preparation plants, and also comment on COM economics. It will also discuss the status of coal-water fuel development.

11761 (CONF-8203103—, pp 10p, Paper 8) **Conversion of an industrial boiler to Coal-Oil Mixture.** Forney, R.H.; Sage, W.L.; Rahbany, E.P. (Stearns-Roger Engineering Corp., Denver, CO). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

The conversion of an industrial boiler to a Coal-Oil Mixture requires the evaluation of the technical and economic feasibility. The major technical considerations are furnace size, convection surface tube spacing, and the suitability of auxiliary equipment. The main economic potential for conversion to a Coal-Oil Mixture is the low cost of coal relative to oil. The cost of conversion to a 50-50 Coal-Oil Mixture, including evaluated cost of fuel, may be a saving of approximately $18 per pound of steam per hour of rated capacity. Each candidate installation must, however, be critically reviewed before a decision can be made to convert.

11762 (CONF-8203103—, pp 16p, Paper 9) **Studies concerning the application of coal-water fuels to boilers designed for oil.** Barsin, J.A. (Babcock and Wilcox Co., Barberton, OH). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

Before 1940, coal served as the principal fuel for utilities. Between 1940 and the early 1970's, however, large sections of the utility industry switched to oil or gas because of costs and environmental concerns. Recently, the increasing cost of oil has led to a renewed interest in coal as a primary fuel. Of the units originally designed to burn oil, few were built with coal firing potential. The majority of oil-designed units are not convertible to conventional pulverized coal firing without major costs and outages. Many units have insufficient service life remaining to justify such extensive modifications. Several alternative fuel options are being evaluated to make the conversion to coal easier. These options include the use of deep-cleaned coal with conventional firing, coal-oil mixtures, or coal-water mixtures. This paper describes the Babcock and Wilcox approach to commercial application of coal-water mixtures as a retrofit fuel.

11763 (CONF-8203103—, pp 7p, Paper 10) **Industrial potentials of coal-alcohol slurry fuels.** Keller, L.J. (Methacoal Corp., Dallas, TX). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

Recent energy and fuels development efforts have been concentrated on a variety of synthetic and alternative fuels, but only one company has concentrated its efforts principally in the new field of coal-alcohol slurry fuels. The fuels may be used to replace oil in boilers. These fuels, which are uniquely different than slurries of coal and any other liquid or liquids are patented in several countries, and the patented and proprietary technologies are available on very reasonable terms to all who have need of them. The economics of these new fuels are relatively simple, once they are understood, but cursory consideration generally leads to incorrect assumptions. The reductions in fuel cost may range from minimal to as much as 30 to 40 percent. An example of the method for calculating the cost, including profits, for coal-alcohol slurry fuels is given. The nature of the fuels and their unique combustion characteristics provide advantages not found in other alternative fuels. Very little boiler derating is expected, and slagging problems may be minimal if slagging occurs at all. These technologies are expected to be applicable to a broader range of coals than other coal utilization methods. The potentials are significant in the industrial boiler fuel field with total use of fuel oil being equal to about 30 to 40 million tons of coal-alcohol slurry fuels per year. The fuels may also be applicable to many gas fired boilers. These fuels provide new, efficient and profitable means for utilizing our abundant natural gas and coal resources to reduce oil imports, increase profits and revitalize industry and the economy.

11764 (CONF-8203103—, pp 9p, Paper 11) **Regulatory constraints on industrial coal utilization.** Marx, W.B. (Council of Industrial Boiler Owners, Fairfax Station, VA). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

This paper examines the three major regulatory constraints on increased industrial coal use: fuel use, clean air, and transportation. It sketches their hisotry, reviews the current situation, and makes some observations on future developments, at both the Congressional and agency levels. Finally, it postulates their impact on the amount of industrial coal burned in 1990.

11765 (CONF-8203103—, pp 11p, Paper 13) **Development and commercialization of circulating fluidized bed combustion systems.** Oakes, E.J. (Pyropower Corp., San Diego, CA). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

Experience with conventional bubbling fluidized bed combustion systems revealed certain problems inherent in scaling them up to large industrial sizes. To avoid these problems and permit scale up in size to outputs in excess of 100,000 lb/hr steam for industrial processes and cogeneration, investigation of circulating fluidized bed combustion was initiated by Ahlstrom. A pilot plant was constructed in 1976 to demonstrate this approach. The goals were achieved in the pilot plant development program and the research and development program resulted in the design of PYROFLOW circulating fluidized bed combustion boilers for subsequent commercial systems.

11766 (DOE/PC/30300—T7) **Particulate processes in pulverized-coal flames. Quarterly technical progress report, April-June.** (Spectron Development Labs., Inc., Costa Mesa, CA (USA)). Nov 1982. Contract AC22-80PC30300. 16p. NTIS, PC A02/MF A01. Order Number DE83003787.

Portions of document are illegible.

During the past two years, significant progress has been made in the application of nonintrusive optical diagnostic methods to particulate processes in combustion. Perhaps the most dramatic application to date is the capture of devolatilization and ignition events of feed coal particles using nano-second pulsed laser holography and shadowgraphy. Equally important are the capabilities (1) to measure simultaneously the size and velocity of individual particles in the range of 3 to 300 μm and (2) to measure the size of individual submicron particles. The latter techniques have been demonstrated in combustion flowfields and offer the opportunity to obtain particle size statistics, an important missing link in the existing mostly qualitative data base for particulate processes in coal flames. A key consideration of the present program will be the development of a laboratory combustor capable of conducting a comprehensive experiment. This implies that temperatures and residence times will be adequate to achieve char and soot burnout and ash vaporization. It is also important that temperatures are not so high as to produce non-realistic reaction rates.

11767 (DOE/PC/40796—4) **Carbon attrition during the fluidized combustion and gasification of coal. Quarterly technical progress report, 1 June 1982-31 August 1982.** Massimilla, L.; D'Amore, M.; Di Muro, N.; Donsi, G.; Filla, M. (Naples Univ. (Italy)). 1982. Contract FG22-81PC40796. 24p. NTIS, PC A02/MF A01. Order Number DE83002471.

The work performed in the period 1 June 1982 to 31 August 1982 has been mainly directed to putting into operation an atmospheric fluidized bed combustor 370 mm ID and carrying out preliminary experiments. This equipment shall be used to check the correlations for bed carbon attrition rates found on a laboratory scale and to investigate elutriation phenomena.

11768 (GFETC/IC—82/1, pp 546-564) **Technical and economic aspects of a lignite-fired AFBC boiler.** McGowin, C.R.; Aulisio, C.; Ehrlich, S. (Electric Power Research Inst., Palo Alto, CA). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Atmospheric fluidized-bed combustion (AFBC) is well-suited for direct combustion of lignite and other low-rank coals. Potential advantages relative to pulverized-lignite combustion include reduced sensitivity to coal quality and variability, elimination of boiler fouling and slagging problems, higher sulfur capture by alkaline ash, and elimination of flue gas desulfurization. EPRI is evaluating two AFBC design concepts for utility boiler application: (1) an AFBC boiler with recycle of solids to the main bed; and (2) a circulating fluid bed (CFB) boiler operating at high velocity and recycle rate. North Dakota Beulah lignite was recently tested at the EPRI Fluidized Bed Development Facility in Alliance, Ohio. The tests were conducted without solids recycle and confirmed the high combustion efficiency expected for the highly-reactive lignite and high sulfur capture by the alkaline ash. Other lignite tests, conduct-

ed in circulating fluid-bed combustion pilot plants during 1981, have demonstrated low NO/sub x/ emissions, high sorbent utilization, and high combustion efficiencies. Conceptual design and economic evaluations sponsored by EPRI indicate a 10 to 20% savings in total capital and revenue requirements for the lignite-fired AFBC/recycle boiler relative to an equivalent pulverized-lignite boiler with wet FGD system. Due to the potential advantages for low-rank coal, it is expected that the first utility-scale application of AFBC will be at a low-rank-coal-fired power plant.

11769 (GFETC/IC—82/1, pp 565-605) **Fluidized-bed combustion studies of Texas lignite.** Talty, R.D. (Grand Forks Energy Technology Center, ND); Hajicek, D.R.; Benson, S.A.; Vander Molen, R.H.; Owen, M.L. 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Research on atmospheric fluidized-bed combustion (AFBC) of low-rank coals has been conducted for over 5 years in pilot plants at Grand Forks Energy Technology Center (GFETC) in Grand Forks, North Dakota, and at Combustion Power Company (CPC) in Menlo Park, California. GFETC has two AFBC units with 0.2-ft^2 and 2.25-ft^2 cross sectional areas, respectively, and CPC has a 7-ft^2 unit. Primary emphasis in the experimental program has focused on the effect of operating conditions on sulfur retention in the bed, heat transfer rates and coefficients, nitric oxides emissions, combustion efficiency, and bed material and fly ash composition and characteristics. Operating parameters have included temperature, ash recycle, superficial gas velocity, bed depth, air/fuel ratio, and the addition of supplementary sorbents. Recent AFBC tests have been performed using Texas lignites to characterize this material and provide basic information useful in developing preliminary designs for industrial applications. The results of these tests indicate that sulfur retention for Texas lignites is significantly less than with North Dakota lignite or many Western subbituminous coals. Multiple factors influence heat transfer to heat exchange surface immersed in fluidized beds. Moreover, heat transfer rates may change during long-duration tests because of surface deposits and agglomerates of bed material. Results from several tests using North Dakota and Texas lignites were examined relative to the effect of tube spacing and configuration, particle size, surface deposits, and other variables affecting AFBC heat transfer coefficients.

11770 (GFETC/IC—82/1, pp 606-626) **Analysis of sulfur retention in fluidized-bed combustion.** Christman, P.G.; Edgar, T.F. (Univ. of Texas, Austin). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

At the present time fluidized-bed combustion (FBC) of Texas lignite appears to have significant commercial potential. Tests on several lignites at various laboratories have shown that with no dolomite injection, highly variable sulfur retention is achieved during combustion in a fluidized bed. The retention of sulfur by the ash alone can be quite significant, although in some cases large amounts of dolomite (5 to 6 times stoichiometric) must be added to achieve 70 to 90% suppression of the sulfur oxide emissions. The test data for both North Dakota and Texas lignites indicate that presently we have only limited knowledge about how the lignite and ash composition and the fluidized-bed operating conditions affect the sulfur retention. Efforts at the University of Texas at Austin have concentrated on analyzing sulfur retention both by the intrinsic ash and by dolomite. The reaction of SO_2 with pellets of limestone or dolomite is complicated by physical effects such as port plugging. This plugging is due principally to the formation of calcium sulfate, which occupies a larger volume than the calcium oxide originally in the pellet. Sintering at high temperature (greater than 950°C) can also reduce surface area, which in turn lowers the conversion of calcium oxide. A mathematical model has been developed which predicts when plugging will occur in a limestone particle. Preliminary experiments to characterize the effect of alkaline ash components on sulfur retention have also been carried out. The widely differing retention characteristics indicate that a more detailed structural and chemical analysis of lignite ash must be performed before the data can be correlated.

11771 (SAND—82-8657) **Temperature and reaction rate of burning pulverized fuels.** Mitchell, R.E.; McLean, W.J. (Sandia National Labs., Livermore, CA (USA)). Nov 1982. Contract AC04-76DP00789. 29p. (CONF-820801—14). NTIS, PC A03/MF A01. Order Number DE83004128.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

A two-color pyrometer technique has been used to measure the temperature of burning pulverized fuel particles flowing in dilute suspension on the centerline of a laminar flow reactor. The transparent reactor is fed by a premixed flat flame fueled with CH_4-H_2-O_2-N_2 mixtures, which permit widely variable post-flame temperatures and oxygen concentrations to be obtained. Planck's law and the gray body assumption (verified here by measurements) are used to compute particle temperatures, and the average temperature is then determined by averaging the values for some 500 individual particles. Particle temperatures have been determined for various gas temperatures over a range of oxygen mole fractions from 0 to 0.2 for size-graded (90 μm mean diameter) samples of a petroleum coke and a flash pyrolysis char. Particle burning rates per unit external surface area were determined from the measured temperatures by a heat balance analysis. The functional variation in burning rate with temperature was then used to infer whether the burning rate was controlled by chemical rates (Zone I), the combined effects of chemistry and pore diffusion (Zone II), or bulk diffusion (Zone III). For the petroleum coke, both Zone I and Zone II conditions were observed, and chemical rate coefficients for each zone were derived. For the char, Zone II and a transition to Zone III conditions were observed, and a chemical rate coefficient for Zone II was derived. Reaction orders and activation energies were in the range expected from previous oxidation studies, and the chemical rates for both samples were in good agreement with previous measurements by a different method in another laboratory. The results show that careful temperature measurements can provide a sensitive method for the determination of pulverized fuel burning rates. 8 figures.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 11595, 11596, 11601, 11649, 11721, 11738, 11743, 11746, 11760, 11786, 11825, 12014, 12273, 12485, 12486, 12493, 12495

11772 (CONF-8108141—, pp 14-22) **How industry views the climate for major synfuels investment in the 80's.** Bowden, J.R. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The preponderance of synthetic fuel production will come, under any reasonable scenario, from present major producers of primary energy. Energy transporting or converting companies and major companies only peripherally involved in the energy industry will be minor producers whose market share can be enhanced by SFC and other Federal Actions. The role of entrepreneural or opportunistic organizations is almost totally dependent upon SFC awards. Significant and sustained commitment to the synthetic fuels industry for all but this last category of sponsors will be heavily influenced by corporate projections of supply and demand. Price deregulation of both gas and oil is necessary to allow building a relatively distortion-free data base strength sufficient to support long range price/demand forecasts. Passage of favorable tax legislation is desireable and indeed is necessary if sizeable volumes of synthetic fuels are to be produced in the late '80's. In short, major primary energy producers need tax relief and relatively free energy markets. These factors are important to transmitting and converting industries as well as major companies in peripheral industries, but these groups will be more influenced by SFC activities. Entrepreneural sponsors will produce a very small amount of synthetic fuel even under ideal circumstances and, should SFC fail to be effective, their contribution will be vanishingly small. SFC will get its act together and become a factor, though a limited one, in the development of the industry. This means, to me, that one or two entrepreneural groups will get a chance to lose their money. Failure of Congress to enact powerful tax legislation will reduce private investment,

placing the SFC in a more dominant position and resulting in reduced synfuels investment in the 80's.

11773 (CONF-8108141—, pp 24-33) **Coal supply factor is it largely romance or a solid plus.** Wilson-Smith, N.G. (Zinder-Neris, Inc., New York, NY). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Our coal is abundant, but the large reserves of coal are thousands of miles fom the markets to be served, and connected only by an increasingly expensive transportation system and those reserves are in a large part controlled by government bodies pursuing policies which discourage investment. Of the two problems - transportation and politics - transportation is the more difficult, and solutions here would do much to reduce political issues. The two principal coal users are electric utilities and synfuel producers. Each shares fairly equally the problems inherent in using coal. To obtain operational efficiency both require large, expensive plants, and this in turn requires long-term and secure supplies of coal at a reasonable price. The financial investment needed is equally massive, and to support it, markets must be identified and assured for at least the life of the investment, at prices which will provide an acceptable return. Both types of plants are voracious consumers of coal. The description of the problems of providing this coal at a reasonable cost over the plant life is obviously a very general and simplified approach to a serious problem. It is offered, however, to show that while coal supply involves complexity and uncertainty, solutions can be evolved which will satisfy the commercial interests of all parties. Careful plant siting will ensure the supply security provided by having alternative sources. Skillful contracting and renegotiation will ensure operational and commercial stability. Coal supply will be adequate to satisfy all demand, both domestic and export, for well into the next century.

11774 (CONF-8108141—, pp 34-40) **Bottom line: can we finance major synfuels construction in the '80's.** Schell, J.M. (Kidder, Peabody & Co., Inc., New York, NY). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Philosophically, the author favors letting the free enterprise system efficiently allocate scarce resources such as capital, labor and hydrocarbons. However, under present conditions (regulated gas price, windfall profits tax on oil and OPEC politically regulated oil prices), he feels private industry will not be willing or able to finance a sufficient number of conversion plants without federal financial assistance. In view of the risks involved, the size of the plants and the constructed time involved he feels only the very largest companies will be involved and even then only for a larger than usual return or equity capital and a state in the future industry. He believes debt capital will be available at a modest interest increase but only with some form of credit support. Of the various forms of credit support, he favors a loan guarantee by the Synthetic Fuels Corporation. He feels somewhat similar arrangements will be made for its various projects. He feels that the forecast price escalation of oil and gas beyond the inflation rate (1 to 3% above inflation) will make synthetic fuels competitive in the future. But commitments by both industry and government need to be made now. (LTN)

11775 (CONF-8108141—, pp 374-377) **Synthetic fuels from coal: our moral equivalent of war.** Cochran, N.P. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The author feels that we did not pursue the synthetic fuels program as a moral equivalent of war and some variation of the planned synthetic fuels program could have been successful and would have put us in a much better position in dealing with OPEC. He gives as reasons why we did not do this: (1) industry was reluctant to take risks; (2) government policy was not consistent (it changed with budget cycle, congress to congress and administration to administration. Also government rules and regulations changed. So as a result, government couldn't decide what it should do); (3) effort on individual programs was diluted by backing to many programs; and (4) announcement of programs by major companies discouraged others while the announced programs were never completed. The author gives recomendations for a synthetic fuels program as of now. (LTN)

11776 (CONF-8108141—, pp 378-394) **Synthetic fuel costs vs oil price.** Jelinek, R.V. (SUNY College of Environmental Science and Forestry, Syracuse, NY); Gushee, D.E. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

To quantify and clarify the present and future relationship between synfuel costs and oil price, seven processes typifying synfuel technology currently under development were evaluated, using established techniques of process engineering analysis. Plant investment and operating costs were projected in relation to anticipated increasing costs of energy, materials and capital. Results of our study show that as oil price rises, projected cost of synfuel from a new plant using currently foreseeable technology increases proportionately. No matter how high the price of oil rises (even to $100 per barrel), a new plant built subsequent to arrival of oil at that price will not be economic, i.e. the necessary selling price of synfuel to achieve economically attractive equity recovery will exceed oil price. However, synfuel operating costs will increase slower than rising oil prices. Thus a synfuel plant built at any oil price, with the required capital investment committed, will become progressively more economic as oil price rises, attaining parity and eventually becoming quite profitable. Quantitative results are presented from our analysis of five coal conversion processes (H-Coal, Exxon Donor Solvent, Fischer-Tropsch, Lurgi SNG and synthetic methanol), Tosco II oil shale treatment and ethanol manufacture via grain fermentation. Specific conclusions and their policy implications for the northeastern United States are discussed.

11777 (CONF-8108141—, pp 395-406) **When should you build a synthetic fuel plant.** Oliver, E.D.; Moll, A.J. (Synthetic Fuels Associates, Inc., Palo Alto, CA). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The history of the progression of imported crude prices has been sudden large jumps separated by relatively long periods of moderate positive or negative real escalation. If a company believes that this pattern will continue and that synthetic fuel prices will behave similarly, the company should get such a plant under construction so it can be built before the inflation occurs that invariably follows the oil price jumps. Product price and capital cost are the two most important factors in the profitability. A jump in product price dramatically improves the profitability. The second important factor in profitability, the capital cost, is subject to fairly sharp rises because of increased construction and financing costs. Costs increase after energy price increases through at least three mechanisms. Direct costs of materials, equipment and operations increase in proportion to their energy requirements. Investments in plants and equipment are stimulated to conserve fuel or provide or use alternative fuels, straining capacities and decreasing competitive pressures in the construction industry. And general inflation increases, e.g., by union demands for catch-up with the cost of living. If a plant is not already under construction at the time of an energy price jump, the chance to avoid the resulting capital cost increase is slim. On paper, near-commercial processes often show substantial advantages over proven commercial processes. Whether the advantages hold in practice depends on whether the plant can be constructed on budget and on schedule and operated as designed.

11778 (CONF-8108141—, pp 416-428) **Synthetic fuels industry in Germany 1927 to 1945.** Donath, E.E. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Looking first at the catalytic coal hydrogenation or direct coal liquefaction process, we see its development beginning with the first sulfur-resistant hydrogenation catalyst as the result of the private incentive of a large company which expected to enter new markets through its research. Commercial production was made possible by govemnent support in the form of a reduced excise tax for Leuna gasoline. This precarious position ended in 1933 when a contract with the government provided for an increase in production and guaranteed purchase of the gasoline at a price that covered the manufacturing cost. The development of the Fischer-Tropsch process at the Kaiser Wilhelm Institute began in 1925 with catalysts that produced higher hydrocarbons. It was the result of many years of work with synthesis gas. Improvements of the catalysts and gas purification continued and, in 1934, the process was ready for the pilot plant. Operation of commercial plants started two years later. The building of commercial plants after 1933 was, for both processes, the result of government decrees or of urging private industry. In all cases the government gave price guarantees for the products which made financing of the plants possible. Direct catalytic coal liquefaction was and remained the preferred and dominant process because of cost, product quality and the aiblity to adapt readily to changing requirements.

11779 (CONF-8108141—, pp 429-436) **Shape and pace of the United Staes synthetic fuels industry.** Koleda, M.S. (National Council on Synthetic Fuels Production, Washington, DC). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

In order to determine where the industry stands in its development plans, our Council recently completed its first survey of the US synfuels industry, working with project sponsors so that our information would be accurate and current. The survey results offer some useful information: Plans exist for almost 100 projects that can be described as potential commercial ventures. These include coal gasification and liquefaction, oil shale, tar sands, heavy oil, and coal-oil mixture projects. The total production of these projects would displace approximately 3 million barrels of oil per day. The 20 shale projects in our survey would account for one-third of this total. Extensive use of coal is also being planned. Sixty-nine projects will be either exclusively coal-based or will combine coal with petroleum, heavy oil, or tar sands products. Coal-derived liquids will be a major product in 35 projects; medium-Btu gas is planned for 21 projects. Pipeline quality high-Btu gas will be produced in 11 cases, and one project would be designed for solid fuel production. More than 40 of the projects have advanced beyond preliminary planning and feasibility studies. More than a dozen are in active development or under construction.

11780 (CONF-8203103—) **Industrial coal utilization: fourth annual symposium.** (Department of Energy, Pittsburgh, PA (USA). Pittsburgh Energy Technology Center). 1982. 182p. NTIS, PC A09/MF A01. Order Number DE83004459.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

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The fourth annual symposium on Industrial Coal Utilization was held April 1-2, 1982, at Stouffer's Cincinnati Towers, Cincinnati, Ohio. It was sponsored by the United States Department of Energy, Pittsburgh Energy Technology Center. Papers involved coal preparation (equipment, benefits and cost benefit analysis), coal transport (railway investment problems, slurry pipeline eminent domain problems), export demand, coal-oil, coal-water and coal-methanol mixtures, energy planning, fluidized-bed combustion commercialization, etc. Fourteen papers have been entered individually into EDB and ERA and three also into EAPA. (LTN)

11781 (DOE/CS/30013—U14) **Rate guide for commercial No. 2 heating oil and coal.** Lambert, S. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Win 1982. Contract FG01-79CS30013. 290p. (UAH-RR—331). NTIS (US Sales Only). Order Number DE83005498.

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The Johnson Environmental and Energy Center (JEEC) of the University of Alabama in Huntsville (UAH) has compiled this listing of commercial No. 2 Heating oil and coal prices for cities included in the SOLCOST Data Bank. This document provides a ready reference for persons needing current price information, particularly those in energy research and in solar heating and cooling industry. The data shown represent one company chosen at random in each city. Only one company name is shown as the team has found that rates of companies in the same city are relatively the same. The name is shown so as to not misrepresent any other companies. The information shown represents the data as quoted by each company and includes the basic rate, the taxes, and the delivery charge. The minimum represents the minimum amount sold to any one customer.

11782 (DOE/ET/10159—T25, pp 107-130) **Peat commercialization projects in Maine and Alaska.** Rohrer, J.W. (Wheelabrator-Frye, Inc., Hampton, NH). 1982. NTIS, PC A18/MF A01.

From 5. technical conference on peat; Bethesda, MD, USA (27 Apr 1982).

Wheelabrator-Frye, Inc. is looking into the possibility of commercializing peat in Maine and Alaska. Maine has the highest alternative energy cost of any state, but it has substantial deposits of peat. It is not possible by mechanical process to extract sufficient water from raw peat to make an economic fuel. However, if the raw peat is first cooked at about 400°C for approximately 15 minutes, most of the water can be removed mechanically. The solids from the filter press are then thermally dried and compressed into the desired shapes. The compressed product is moisture proof and can be stored outside without reabsorbing moisture. The process is licensed from JP Energy OY of Helsinki. Other feasibility studies are being made in Alaska, where there are even larger deposits. Several process possibilities will be assessed. Economic feasibility will be an important factor in both cases. (LTN)

11783 (DOE/NBB—0020) **Documentation of the Resource Allocation and Mine-Costing (RAMC) model.** (Synergic Resources Corp., Bala-Cynwyd, PA (USA); Oak Ridge National Lab., TN (USA)). Sep 1982. Contract W-7405-ENG-26. 165p. NTIS (US Sales Only). Order Number DE83005452.

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The RAMC is a computerized model designed to translate information on coal reserves and cost factors in the development of new mines into a set of long-term supply curves that depict the relationship between price and production for specific coal types from different supply regions. To provide a flexible tool for coal supply analysis, the RAMC incorporates detailed representations of coal supply regions, coal types, and classes of mining. The cost of coal that will be produced in the future is affected by many factors that include financial factors in the coal and electric utility industries, capital, labor and other operating costs, and costs related to government regulation and taxes. The RAMC incorporates these factors, and permits them to be varied by supply region and type of coal where appropriate. The detail inherent in the RAMC supply curves permits a wide range of application. The principal EIA model using the RAMC supply curves is the National Coal Model (NCM). In addition, the RAMC supply curves are used in the International Coal Trade Model (ICTM), the Mid-term Energy Forecasting System (MEFS), The Coal Supply and Transportation Model (CSTM), and the Long-term Energy Analysis Program (LEAP). They are also a source of long-term supply inputs for the Intermediate Future Forecasting System (IFFS) currently under development by EIA. The RAMC permits a coal market model to investigate a wide range of issues. For example, issues relating to federal leasing can be addressed by varying the reserves available to the model, the effect of alternative pollution requirements can be modeled because sulfur content is explicitly represented in detail, state tax policies can be modeled because all regions are states or substate areas, changes in reclamation requirements of both state and federal levels can be incorporated in the coal supply analysis, and the impact of both union wage and pension agreements can be modeled.

11784 (NP—3900697) **Summary of mineral industry activities in Colorado. Part I: coal.** Pascoe, D.M. (Colorado Div. of Mines, Denver (USA)). 1981. 29p. Colorado Div. of Mines, 1313 Sherman St., Room 718, Denver, CO 80203.

Coal production for 1981 was a record, with production at 19,701,496 tons of coal mined and reported to the Division of Mines. This was a 4.95% increase over 1980. Statewide Divisional efforts to support a practical type of health and safety training program while encouraging skill education appropriate to mining needs, saw extensive accomplishment in 1981. The Division gave direct or monetary support through training grant funds, largely used for reimbursed tuition from strategically located state vocational schools who taught on campus as well as at mine sites. Total miner training reported by area schools to the Division of Mines indicates that 8408 students received 86,251 hours of classroom and on-the-job training. It is hoped that the education and training programs throughout the state will be continued in an effort to educate both the new and old miners. We believe this is the best approach to the coal industry's never ending task of reducing both lost-time and fatal accidents. Coal mine certification in all categories totaled 780 certificates issued. This was a decrease from 1980, and will probably decrease again in 1982 with the initiation of the $25.00 fee for each examination. Coal mining activity is reported by district.

11785 (TENRAC/EDF—079) **Feasibility study of a Texas lignite-gasification facility to fuel: a small industrial plant. Final report.** (Black, Sivalls and Bryson, Inc., Houston, TX (USA)). Jul 1982. 138p. NTIS, PC A07/MF A01. Order Number DE83900809.

Portions of document are illegible.

A feasibility study was carried out of producing low-Btu gas (160 Btu/SCF) from Texas lignite and using the produced gas to substitute for natural gas fuel in an existing tunnel-type brick kiln being operated by Elgin-Butler Brick Company in Elgin, Texas. The design capacity of the gasification facility was 775 million Btu/day or 134 barrels of oil equivalent per day. The primary motivation for undertaking this study stemmed from (1) the ready availability of lignite at Elgin-Butler's plant site, and (2) the potential for application to Texas lignite of the commercially proven, atmospheric pressure, low-Btu, fixed-bed Galusha-type gasifier technology at a scale sufficiently small as to be particularly attractive to small-scale industrial applications. It is hoped that the findings of this study would generate interest in the small-scale industrial sector in similar retrofit or new applications at sites favored by nearness to lignite deposits. The following significant conclusions resulted: (1) Gasification of Texas lignite in fixed-bed gasifiers is technically feasible with the feedstock both in the form of briquettes and raw screened material. (2) Successful gasifier operation at low pressure with raw screened Texas lignite (larger than 0.75 inch) was separately demonstrated for producing low-Btu gas, but certain factors may render it economically less attractive. (3) Economic analysis of a low-Btu, single-stage, fixed-bed gasification facility, based on briquetted lignite feed, for retrofitting an existing facility using natural gas indicates a simple four-year payback after depreciation and taxes but without discounting or allowance for inflation. This assumes an increasing natural gas cost of $3.62/MMBtu in 1982 and $6.00/MMBtu in 1986. (4) The findings of this study have significantly influenced Elgin-Butler Brick Company's decision to independently pursue implementation of a lignite gasification facility at Elgin.

0160 Health And Safety

REFER ALSO TO CITATION(S) 11599, 11740, 11784, 12284, 13178

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 11745, 11772, 12494

11786 (CONF-8108141—, pp 364-373) **Commercialization status - DOE programs.** Passman, R.A.; Singer, M.I. (Dept. of Energy, Washington, DC). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Significant progress in the commercialization of synthetic fuels has been made in the past year, largely in response to two events. The first concerns the solicitations by the Department of Energy to sponsor feasibility studies and cooperative agreements for commercial synthetic fuels facilities. Twenty-one such coal synthetics projects have been sponsored, representing a DOE outlay of some $107 million. The second event was the solicitation from the Synthetic Fuels Corporation, to which there were 63 responses. (A list of the projects that were selected for DOE awards, and/or had applied to the Synthetic Fuels Corporation is included as Tables 1 and 2. In all, some 25 coal gasification projects and 27 coal liquefaction projects have been identified as a result of these two events. Our work with the feasibility studies and cooperative agreements has given us an overview of this developing industry. We believe this overview can be useful in helping all projects move forward from the planning stages to construction and operation.

11787 (NP—24380) **Notes for an address on coal.** Ashe, G. (Ontario Ministry of Energy, Toronto (Canada)). 25 Feb 1980. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83901085.

Ontario's energy comes from hydraulic power (38%), nuclear power (32%) and coal-fired power plants (28%). The main users of coal in Ontario are Ontario Hydro and the major steel companies (the consumption of other industries is less than 1 million tons annually). Until recently Ontario has imported US coal, which has been transported by ship or railway. More recently, some Canadian coal has been transported from the western provinces at a for greater cost of transport (for assurance of supply and Canadian balance of payments). The growth of Ontario demands for coal is expected to be moderate in the forseeable future and changes or improvements in transportation methods or routes are expected (but not real laye changes). Some environmental problems such as sulfur dioxide and acid rain are mentioned with the possibility that better coal preparation will help. Canada cannot devote large amounts to coal research but does monitor much research in other countries. The author is concerned about future crude oil supplies and the extent to which coal can be a substitute. (LTN)

02 PETROLEUM

11788 (NP—3900983) **Wyoming's oil and gas industry. Public information circular No. 17.** Ver Ploeg, A.J. (Wyoming Geological Survey, Laramie (USA)). 1982. 33p. Wyoming Geological Survey, P.O. Box 3008, University Station, Laramie, WY 82071.

Portions of document are illegible.

This report contains a concise picture of oil and gas activities in Wyoming through 1981. The geology of the area is briefly discussed. Drilling and production data are included. The possibility of developing Wyoming's oil shale is addressed. All major aspects of the oil and gas industry are represented in Wyoming from seismic exploration and development drilling to transporting and refining the product. Oil and gas have played a major role in the state's economy since the turn of the century and should continue to do so into the next century. (DMC)

0201 Reserves

11789 (CRA—489.06-Vol.1) **Evaluation of policy options for increasing domestic oil inventories. Final report.** (Charles River Associates, Inc., Boston, MA (USA)). Dec 1982. Contract AC01-79PE70013. 148p. NTIS, PC A07/MF A01. Order Number DE83004936.

Five criteria are identified for choosing among alternative policy options: Resource costs. What is the oppotunity cost of the resources absorbed under alternative policy options; Predictability. How confident can policy makers be that alternative policy options will actually produce the intended result; Control. In this report the term control is used to mean the authority to draw down stragetic stocks of petroleum. Who is best able to make decisions regarding stockpile draw-down; Who pays. Who bears the costs of stockpiling petroleum; and Federal budget impact. What implications do alternative policy options have for federal budget outlays. Discus-

sions center around private versus public incentives to stockpile (PSB)

11790 **(CRA—489.06-Vol.2) Evaluation of policy options for increasing domestic oil inventories. Volume 2. Policies to increase petroleum inventories in the secondary and tertiary sectors. Final report.** (Charles River Associates, Inc., Boston, MA (USA)). Dec 1982. Contract AC01-79PE70013. 46p. NTIS, PC A03/MF A01. Order Number DE83004937.

Potential government initiatives are described and evaluated that would lead to increased petroleum inventories in the secondary (petroleum product distribution) and tertiary (end-use) sectors of the oil industry. The policies discussed are designed to lead to physical oil storage by these sectors.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 12251, 13204, 13213

11791 **(NP—3900959) Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21.** Ver Ploeg, A.J.; De Bruin, R.H. (Wyoming Geological Survey, Laramie (USA)). 1982. 135p. Wyoming Geological Survey, P.O. Box 3008, University Station, Laramie, WY 82071.

Portions of document are illegible.

The portion of the overthrust belt located in northeastern Utah, western Wyoming and southeastern Idaho is considered by the oil and gas industry to be the hottest new oil and gas province in the continental United States. The Cordilleran fold and thrust belt extends from northern Alaska to southern Mexico. Very significant oil and gas reserves were identified in the Canadian thrust belt as early as 1913. However, until the Pineview success in 1975, most geologists felt that the Utah-Wyoming-Idaho salient probably retained very little oil and gas because of its long and complicated history of deformation, uplift, and erosion. Most did agree that sufficient thicknesses of sediments and the required facies for petroleum generation and migration did exist. Modern refinements of seismic exploration techniques have helped unravel the complex geology, and have led to the enormous successes that now characterize the area. This report catalogs the development of geologic knowledge of the area, describes its general geology and petroleum exploration history, profiles the important new oil and gas fields, and discusses some of the obstacles and problems faced by industry in developing this significant new oil and gas province.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 12801

11792 **(CONF-820419—Suppl.) SPE/DOE symposium on enhanced oil recovery. Proceedings supplement.** (Society of Petroleum Engineers (AIME), Dallas, TX (USA); Department of Energy, Washington, DC (USA)). 1982. 41p. NTIS, PC A03/MF A01. Order Number DE83004568.

From Enhanced oil recovery symposium; Tulsa, OK, USA (4 Apr 1982).

The Third Joint Symposium on Enhanced Oil Recovery sponsored by the Society of petroleum Engineers and the US Department of Energy attracted 2397 engineers, scientists, educators, and other persons interested in this subject from 15 different countries in addition to the United States. Besides the technical papers, which covered all phases of enhanced oil recovery and were published in the Proceedings, the symposium included an opening general-interest session, an evening session on Emerging EOR Technologies, and two luncheon speakers. The evening enhanced oil recovery session presented the state-of-the-art for enhanced oil recovery by light oil steamflooding, gravity drainage, and microbial technology. These papers are included in this Proceedings Supplement under the following titles: Light Oil Steamflooding; Microbial Enhancement of Enhanced Oil Recovery; and North Tisdale Mine-Drainage Project. All three papers have been abstracted and indexed for the Energy Data Base.

11793 (CONF-820419—Suppl., pp 13-23) **Light oil steamflooding: an emerging technology.** Blevins, T.R.; Duerksen, J.H.; Ault, J.W. 1982. NTIS, PC A03/MF A01.

From Enhanced oil recovery symposium; Tulsa, OK, USA (4 Apr 1982).

This paper discusses the extension of the steamflood process to the recovery of light oil and a state-of-the-art review of this emerging technology. A review of the various steamflood mechanisms indicates that distillation will dominate if steam is injected into light oil reservoirs. Several light oil steamflood projects have been initiated and others are being planned. A rough screening guide for selecting a light oil steamflood condidate is discussed. New areas of advanced steamflooding technology need to be developed and field tested before light oil steamflooding can be applied on a routine basis as is currently the case for heavy oil steamflooding. 13 figures, 5 tables.

11794 (CONF-820419—Suppl., pp 25-32) **Microbial enhancement of oil recovery.** Donaldson, E.C. 1982. NTIS, PC A03/MF A01.

From Enhanced oil recovery symposium; Tulsa, OK, USA (4 Apr 1982).

The US Department of Energy has sponsored several projects to investigate the feasibility of using microorganisms to enhance oil recovery. The work developed out of an environmental concern for the biodegradability of chemical compounds that are proposed for use to enhance oil recovery. Microbes extracted from a depth of 1000 meters in the Wilmington field, California, were found to be stimulated in growth by polyacrylamide mobility control polymers. The microbes also can reduce the viscosity of the polymer solution. Microbes have been discovered that produce excellent surface active molecules as metabolic products both aerobically and anaerobically, and several mixed cultures have been developed that are capable of effecting drastic reductions of the viscosity of heavy oils. 5 figures, 2 tables.

11795 (CONF-820419—Suppl., pp 33-38) **North Tisdale Mine: gravity drainage project.** Smith, S.S.; Sidwell, J.V. 1982. NTIS, PC A03/MF A01.

From Enhanced oil recovery symposium; Tulsa, OK, USA (4 Apr 1982).

The North Tisdale Mine: gravity drainage project discusses the use of mining technology to recovery shallow oil reserves from a reservoir opererating almost entirely under gravity drainage. Development of this reservoir by conventional methods was not economical due to low production rates. Two different techniques have been used to develop the 300 ft (91.4 m) deep Lakota sand in Wyoming's North Tisdale Field. The first project was begun in 1977 with access to the Lakota being gained through a horizontal tunnel or adit. The second project, initiated in 1981, will provide access to the Lakota through a 16 ft (4.9 m) diameter vertical shaft. In both projects, the plan was to enhance the gravity drainage effect by boring horizontal holes along the strike of the formation from a drilling chamber in the formation. The oil drains in a sump, and is then pumped to the surface by a conventional beam pump. The horizontal holes are currently being drilled in the vertical shaft. A new technique for drilling drain holes is being used to drill several relatively short deviated holes off of the horizontal hole in order to expose more of the formation. The production history of the adit project as well as cost figures, production projections, and economics of the projects are also presented. 9 figures.

11796 **(DOE/BC/10100—4) Development of a rapid and accurate method for determining partition coefficients of chemical tracers between oils and brines (for single well tracer tests). Final report.** Carlisle, C.T.; Kapoor, S. (Geochem Research, Inc., Houston, TX (USA)). Dec 1982. Contract AC19-79BC10100. 48p. NTIS, PC A03/MF A01. Order Number DE83005239.

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The objective of this work was as follows: (a) To develop a rapid and accurate method for determining chemical tracer partition coefficients (K-Values). (b) To study how common reservoir parameters (brine salinity, temperature, crude oil characteristics, gas-to-oil ratio and chemical tracer concentration) effect chemical

tracer partition coefficients. We have developed a high pressure (up to 5000 psig), high temperature (up to 220°F) system for rapidly and accurately determining chemical tracer partition coefficients for an oil/brine system. Reservoir brine is circulated in a closed system of known volume. This system is comprised of an equilibrium cell in which a known volume of oil is held stationary and a brine circulating loop. Known aliquots of chemical tracer are added to the system and the concentration of the chemical tracer in the brine phase is analyzed via gas chromatograph. A tracer mass balance is used to determine the concentration of the chemical tracer in the oil phase and hence, the partition coefficient is determined. Ethyl acetate partition coefficients were studied over a wide range of ethyl acetate concentrations, reservoir temperatures and brine salinities for a highly naphthenic crude oil. Some experiments were also conducted to determine the effect of gas-to-oil ratio and crude oil type on the partition coefficients. In general, the ethyl acetate partition coefficients increased with an increase in temperature, ethyl acetate concentration and brine salinity while a slight decrease was observed for an increase in the gas-to-oil ratio. We have correlated the experimentally determined ethyl acetate partition coefficients with the ethyl acetate concentrate, temperature, brine salinity and the gas-to-oil ratio. This correlation can predict K-Values to within +- 10%. 5 figures, 3 tables.

11797 **(DOE/MC/16140—T2) Determination of miscibility pressure by direct-observation method. Quarterly report, July 1-September 30, 1982.** Wang, G.C. (Alabama Univ., Tuscaloosa (USA). Dept. of Mineral Engineering). 1982. Contract AC21-81MC16140. 14p. NTIS, PC A02/MF A01. Order Number DE83000436.

The objective of the project is to conduct laboratory tests to: (1) develop a method for determining miscibility pressure (MMP) through direct observation using a high pressure cell; and (2) determine feasibility of in-situ foam generation by visual observation and microphotographic technique. The project is organized and carried out in three major tasks, i.e., (1) MMP test; (2) high pressure sampling and chemical analysis; and (3) foam study and displacement test. The MMP test was 100% completed. The summary and results were presented in the last quarterly report. Chemical analysis using the HP5880-A was continued for SACROC crude oil at 76°F and 150°F and was also conducted for Rock Creek crude oil at 78°F and 120°F. Generally speaking, the changes of crude oil composition caused by CO_2 extraction are similar for both crude oils. During this reporting period, 29 displacements were performed for SACROC and Rock Creek crude soils. Results are discussed. 5 figures, 1 table.

11798 **Well-loss function and the skin effect: a review.** Ramey, H.J. Jr. (Stanford Univ., CA). *Geological Society of America, Special Paper;* No. 189, 265-271(1982). (CONF-790284—).

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

The well-loss function, CQ², and the effective wellbore radius constitute two very important ideas in Jacob's classic study (1947). Both ideas were accorded extreme importance in the petroleum engineering field. Swift and Kiel published results of their award-winning study on non-Darcy flow in 1962, and the skin-effect concept (related to effective wellbore radius) was presented independently by both Hurst and van Everdingen in 1953. Jacob's well-loss function has been generalized to the form CQ/sup n/ in the current literature, although this form seems to work well only over the range of flow rates used in testing. The petroleum engineering approach suggests that the form should be C(S/sub T/ + DQ)Q, where S/sub T/ is the skin effect, a constant, and D is the non-Darcy flow coefficient, often a constant also. The new form contains CQ/sup n/ as a special case for a limited range of flow; however, n values would lie between 1 and 2. Field experience in water-well testing indicates n values from 2.5 to 2.7. Fetkovich (1973) presented information on oil and gas flow indicating that transmissivity depends upon pressure (thus also upon flow rate) for solution gas-drive oil production. There appears to be an analogy possible for high-rate production of gas-saturated water. 2 figures.

11799 **Interfacial phenomena in enhanced oil recovery.** Wasan, D.; Payatakes, A. (eds.). New York, NY; American Institute of Chemical Engineers (1982). 126p. (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

The aspects of interfacial phenomena important to tertiary oil recovery discussed include fundamental aspects of the oil displacement processes, interfacial properties and phase behavior, fluid microstructures, petroleum component properties, dynamic phenomena including droplet coalescence and entrapment processes, surfactant precipitation and redissolution, flow through porous media, and inaccessible pore volume and slip phenomena in polymer flow.

11800 **Fluid microstructures and enhanced oil recovery.** Puig, J.E.; Scriven, L.E.; Davis, H.T.; Miller, W.G. (Univ. of Minnesota, Minneapolis). *AIChE (American Institute of Chemical Engineers) Symposium Series;* **78**: No. 212, 1-27(1982). (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

Ultralow interfacial tensions between oil and water are caused not by monolayer adsorption but by a film of surfactant-rich third phase-either viscous material derived from liquid crystalline dispersions, or less viscous equilibrium microemulsion. The sometimes transparent dispersions, which had been overlooked before, become ultradispersions of vesicles upon sonication, and can be dissolved by certain alcohols. These and other findings are summarized from a concerted study of a petroleum sulfonate surfactant system representative of surfactant waterflooding, and of pure surfactant systems that mimic it. Reviewed are the relationships between surfactant-rich microstructures and their compositions, recovery of residual oil from short sandstone cores, and surfactant retention in such cores. Vesicular surfactant delivery is examined. 87 references.

11801 **Liquid crystals and microemulsions in oil recovery.** Miller, C.A.; Mukherjee, S.; Benton, W.J.; Natoli, J.; Qutubuddin, S.; Fort, T. Jr. (Carnegie-Mellon Univ., Pittsburgh, PA). *AIChE (American Institute of Chemical Engineers) Symposium Series;* **78**: No. 212, 28-41(1982). (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

Studies of aqueous solutions of petroleum sulfonate and pure anionic surfactants were made using polarizing microscopy, polarized light screening, and viscometry. Liquid crystalline material as found in the composition range of interest for oil recovery. A general pattern of structure variation with salinity was found and related to variations in viscosity. Microemulsions formed when oil is added to these solutions were studied with several techniques. Measurements of phase continuity and drop size with the ultracentrifuge in several systems showed that the surfactant or middle microemulsion phase is oil continuous in some portions of its range of existence and water continuous in others with some other structure as yet unknown in the inversion region. These results are consistent with mechanisms of surfactant phase formation and of the origin of ultralow interfacial tensions which are described. 19 figures.

11802 **Ultra-low IFT, phase behavior and microstructure in oil/brine/surfactant/alcohol systems.** Noronha, J.C.; Shah, D.O. (Univ. of Florida, Gainesville). *AIChE (American Institute of Chemical Engineers) Symposium Series;* **78**: No. 212, 42-57(1982). (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

The importance of interfacial phenomena to tertiary oil recovery by the surfactant-polymer flooding process is emphasized. Five areas of this process are reviewed, (1) interfacial properties and phase behavior, (2) microstructure, (3) dynamic phenomena, (4) surfactant-polymer incompatibility and (5) flow through porous media. In each area, the rationale behind the study is emphasized. Important concepts detailed and examples are given of experimental data. From these results, the factors that control the efficiency of

the oil recovery process are identified and methods for optimizing these parameters discussed. 99 references, 22 figures.

11803 **Interfacial effects upon displacement in sinusoidal capillaries.** Giordano, R.M.; Slattery, J.C. (Northwestern Univ., Evanston, IL). *AIChE (American Institute of Chemical Engineers) Symposium Series;* 78: No. 212, 58-69(1982). (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

An integral inequality for the Helmholtz free energy is used to predict the stable, static positions of a fluid-fluid interface in a sinusoidal pore as a function of pressure drop. Washburn's equation is generalized to explain the relative effects of the interfacial viscosities, interfacial tension, and wetting during displacement through such a pore. The limits on the creeping motions between Haines jumps are approximately identified with the limits of static stability. The predictions of a prior qualitative theory for the relative effects of the interfacial viscosities and of interfacial tension during tertiary oil recovery are fully supported. Further, the interfacial dilatational viscosity is indicated to be relatively more important than the interfacial shear viscosity. 41 references, 10 figures.

11804 **Investigation of the inaccessible pore volume phenomena.** Liauh, W.C.; Duda, J.L.; Klaus, E.E. (Pennsylvania State Univ., University Park). *AIChE (American Institute of Chemical Engineers) Symposium Series;* 78: No. 212, 70-76(1982). (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

Inaccessible pore volume effects in cores and packed columns of crushed reservoir rock were elucidated by the measurement of the polymer elution volume as a function of polymer molecular weight and rock permeability. This study indicates that the equilibrium distribution of polymer molecules between various size pores is the main mechanism for the inaccessible pore volume effects. This distribution is associated with the loss of conformational entropy associated with the transfer of a random-flight polymer chain from a bulk phase to the limited space inside a pore. This mechanistic interpretation indicates that during polymer flooding, the polymer concentration in a pore is a function of the pore size and the polymer molecular weight. 7 figures.

11805 **Oil banking phenomena in surfactant/polymer and caustic flooding: droplet coalescence and entrapment processes.** Wasan, D.T; Milos, F.S.; DiNardo, P.E. (Illinois Inst. of Tech., Chicago). *AIChE (American Institute of Chemical Engineers) Symposium Series;* 78: No. 212, 105-112(1982). (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

This paper summarizes results of our basic study of coalescence phenomena, emulsion formation and stability, and dynamic interfacial properties when crude oils are contacted with aqueous solutions of surfactant/polymer and alkaline agents. These measurements are correlated with each other and with observations on oil bank formation and displacement and recovery efficiency by chemical flooding in microwave monitored core flooding experiments using the soluble oil and the aqueous surfactant systems. Cinephotomicrographic observations into the mechanism of tertiary oil displacement were conducted in a model porous medium. These observations suggest that in situ formation of stable emulsions severely detracts from a successful surfactant/polymer recovery process and that the slowly coalescing system leaves more reentrapped oil behind. The beneficial role of alcohols or cosolvents in tertiary oil recovery is discussed. The acidic crude oil from California has been fractionated, and the dynamic interfacial behavior of each fraction has been examined and compared with that of the whole crude. Acidic resins naturally occurring in crudes have been found to be responsible for a variety of interfacial phenomena in acidic oil-aqueous alkaline systems. Microwave monitored core flooding tests have been conducted using the two acidic crude oils versus sodium hydroxide and sodium orthosilicate systems. In addition, microvisual observations of the mechanisms of tertiary oil displacement have been made. It has been concluded that oil swelling in addition to interfacial tension, emulsification phenomena and wettability reversal may be a major contributing factor in the alkaline stimulated oil recovery processes. 9 figures, 2 tables.

11806 **Magnitude and role of dynamic interfacial effects in low tension flooding.** Flumerfelt, R.W.; Oppenheim, J.P.; Son, J.R. (Univ. of Houston, TX). *AIChE (American Institute of Chemical Engineers) Symposium Series;* 78: No. 212, 113-126(1982). (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

Droplet-droplet coalescence experiments in an inclined spinning drop device, coupled with an appropriate film drainage model, provide the basis for obtaining estimates of the combination eta = $k' + \epsilon$ of the apparent surface dilational viscosity k' and the intrinsic surface shear viscosity ϵ for low tension oil/water/surfactant systems. In general, the values for eta are found to be extremely small, typically between 0.01 to 1 mPa s m, with the smallest values occurring in the optimal salinity region. For low tension processes operating at or near optimal salinity, the results suggest that dynamic interfacial effects would be of secondary importance compared to bulk phase and interfacial tension effects. Only in the case of oil ganglia reconnection would such effects appear to be of importance, and only then, for conditions outside the three phase, optimal salinity region. 54 references, 5 figures, 3 tables.

0204 Processing

REFER ALSO TO CITATION(S) 11809, 12538

11807 (CONF-801030—Vol.3, pp 965-979) **Oil refining flexibility and alternative fuels.** de Souza, J.A.L. (Petroleo Brasileiro SA., Rio de Janeiro). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

This analysis of the evolution of the production of oil by-products in Brazil focuses on the period after 1960, when production capacity reached around 70% of consumption. From this moment on, the refining facilities installed by PETROBRAS were able to meet the market satisfactorily despite fluctuations in demand over the years. At present, gasoline is being rationalized, through blending with alcohol, so that increasing diesel consumption has had to be met by altering the refining structure. Diesel oil specifications have been modified by incorporating heavy naphtha. In the future, coal will be consumed in the place of diesel oil to a large extent, and installation of further facilities for production of petroleum coke will make it possible to balance output and demand, both for fuel oil and for petroleum coke. Other processes (visco-reduction, cracking, gasification) may be used to modify the refining structure and vary the supply of LPG, gasoline, diesel oil and fuel oil. The analysis also covers the interaction of other alternative fuels (vegetable oils, charcoal, etc.) and with the oil refining structure.

11808 **(ORO—5262-5) Refinery energy profile. Final report.** Maier, R.W.; Olivent, W.P.; Brandt, D.L.; Golden, T.G. (Gulf Research and Development Co., Pittsburgh, PA (USA)). Jan 1979. Contract AC05-77CS40093. 303p. NTIS, PC A14/MF A01. Order Number DE83006018.

Energy profiles are needed to identify areas with the greatest potential for achieving future energy savings. These profiles are essentially detailed energy balances of refineries showing all inputs and losses for the total refinery and for each of the individual processing units. By also showing the losses from each individual heater, exchanger, etc., the items with the greatest potential for saving energy are pinpointed. This report summarizes the work carried out by Gulf Research and Development Company at Gulf's Alliance refinery. This effort has developed a technique for preparing energy profiles at any refinery. In addition to the report, the work has resulted in the preparation of a User's Guide as a separate document outlining the procedures to follow in preparing energy profiles at any refinery. Although the objective of the contract was to develop the technique, some of the numerical results of the study at Alliance are of interest. analysis of the Alliance profiles showed that about 75% of the energy leaving the refinery was lost from

two areas; heater stacks (25%) and air and water cooled heat exchangers (50%). Further analysis led to estimates of the amount of energy potentially recoverable from these two areas. The energy profile for the Alliance refinery is summarized in Figures S-1, S-2, S-3, and S-4.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 11760, 11776, 11777, 11781, 11969, 12014

11809 **(DOE/BC/10102—1) Impacts of alternative-engine technology on the refining industry.** Dickson, J.C.; Frederick, F.P.; Karvelas, L.P. (Bonner and Moore Management Science, Houston, TX (USA)). Nov 1982. Contract AC19-78BC10102. 266p. NTIS, PC A12/MF A01. Order Number DE83003617.

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The objectives of this study are to evaluate the cost and energy use impacts on the petroleum refining industry of various alternative highway vehicle engine developments. This report presents premises. methodology and results of this study. Results from this study clearly indicate that future shifts in the US automotive fuels market--specifically shifts away from gasoline demand and toward alternative fuels--holds the potential for large-scale savings in future costs for manufacturing highway fuels. The study started with a projection of refinery costs which would attend a continuation to the year 2000 of today's gasoline-oriented engine technology. Results from this baseline were compared with results from various cases, which included development and introduction of new engine technology during the same time frame. Alternative fuels considered in the demand shift cases were: (1) diesel fuel, which carries no requirement for octane quality, and; (2) broadcut fuel, which carries neither octane or cetane quality requirements. Comparisons for the year 2000 show that the greatest impact on refining costs would stem from a reduced requirement for raw materials due to an improvement in the miles-per-gallon efficiency assumed for future autos. The second most significant impact stems from a reduced requirement for investment in refinery processing facilities. Third most important, but still a significant factor, is the saving which would accrue specifically from the shift to manufacture of alternative fuels--namely a reduction in energy requirements as a result of lower severity in refinery processing. 14 figures, 171 tables.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 12270, 13063, 13101

0210 Legislation And Regulation

11810 **(DOE/EP—0081) Report to the Congress: comprehensive energy - emergency response procedures.** (Department of Energy, Washington, DC (USA)). 31 Dec 1982. 92p. NTIS, PC A05/MF A01. Order Number DE83005271.

Section I describes the Administration's strategy for petroleum disruptions. Section II describes the Federal Government's emergency management procedures. Section III describes the response measures that the Government would consider using during petroleum supply disruptions. Finally, Section IV identifies several areas currently under study within the Administration to determine whether additional or amended statutory authority is appropriate or necessary to adequately prepare for and respond to a petroleum supply disruption. An Appendix describes in more detail some of the potential response measures and other initiatives related to emergency preparedness activities and authorities.

11811 **(DOE/RG/10572—1) Analytical history of the entitlements program.** (Plett (Robert) Associates Ltd., Arlington, VA (USA)). Dec 1982. Contract AC01-82RG10572. 283p. NTIS (US Sales Only). Order Number DE83004445.

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The entitlements program was implemented effective for the month of November 1974. It was an attempt to achieve the equitable distribution of domestic, low priced crude oil among domestic refiners and to assure that petroleum products were generally sold at equitable, competitive prices in all regions of the United States. The program was a principal part of the body of allocation and price regulations implemented to achieve the objectives of the Emergency Petroleum Allocation Act of 1973, and subsequent laws. With the passage of time, the program grew in complexity and scope, and special provisions were introduced. The entitlements program was further complicated by an active exceptions process and a series of court decisions. There have been numerous lawsuits concerning the program. There were a total of 167 Federal Register publications pertaining to the regulatory structure of the program, and there were an additional 91 publications pertaining to the monthly entitlement notices. The entitlement notices, the monthly entitlement data and the regulations themselves contain a wealth of information with respect to petroleum industry operations, including both crude oil and products. Accordingly, this report has been prepared to achieve the following objectives: to provide a single, comprehensive historical and analytical record of the entitlements program; to gather under one cover a complete legislative and regulatory history of the entitlements program; to analyze all entitlements program elements to show concisely the impacts on various sectors of the industry; and to provide a reference book for use in related research activity.

11812 **(DOE/RG/10572—3-Vol.1) Analytical history of the entitlements program. Entitlement notices, November 1974-December 1977.** (Plett (Robert) Associates Ltd., Arlington, VA (USA)). Dec 1982. Contract AC01-82RG10572. 212p. NTIS (US Sales Only). Order Number DE83004694.

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A chronological collection from Federal Register publications of all entitlement notices and corrections have been assembled in 2 volumes. These volumes serve as a reference source for the analytical history of the program (DMC)

11813 **(DOE/RG/10572—3-Vol.2) Analytical history of the entitlements program: entitlement notices, January 1978-December 1980.** (Plett (Robert) Associates Ltd., Arlington, VA (USA)). Dec 1982. Contract AC01-82RG10572. 254p. NTIS, PC A12. Order Number DE83004994.

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A chronological collection from Federal Register publications of all entitlement notices and corrections have been assembled in 2 volumes. These volumes serve as a reference source for the analytical history of the program. (DMC)

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 11821, 12477

0230 Properties

REFER ALSO TO CITATION(S) 12761

11814 **Modified cetane scale for low-ignition-quality fuels.** Henein, N.A.; Elias, N.Y. Warrendale, PA; Society of Automotive Engineers, Inc. (1978). 25p. (CONF-780683—3). Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.

From Passenger car meeting; Troy, MI, USA (5 Jun 1978).

A detailed analysis has been made on the Cetane Scale presently used to rate the autoignition quality of fuels. The effect of the increase in temperature and pressure, as a result of increasing the compression ratio, on the ignition delay has been theoretically and experimentally analyzed. It has been found that the ignition delay is more sensitive to air temperature than air pressure. The sensitivity increases with the drop in the cetane number of the fuel. Many techniques have been examined to modify the present cetane scale. A modified scale has been developed by raising the inlet temperature from 150°F to 350°F without changing the rest of the rating technique. The modified scale is very effective in extending the

scale to zero cetane number and is able to rate the low ignition quality fuels. 32 figures, 3 tables.

0250 Combustion

REFER ALSO TO CITATION(S) 11758, 11760, 11761, 11771, 12646

11815 (SAND—82-8882, pp 101-130) **On the temperature and reaction rate of burning pulverized fuels.** Mitchell, R.E.; McLean, W.J. (Sandia National Labs., Livermore, CA). Oct 1982. NTIS, PC A08/MF A01.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

A two-color pyrometer technique has been used to measure the temperature of burning pulverized fuel particles flowing in dilute suspension on the centerline of a laminar flow reactor. The transparent reactor is fed by a premixed flat flame fueled with CH_4-H_2-O_2-N_2 mixtures, which permit widely variable post-flame temperatures and oxygen concentrations to be obtained. Planck's law and the gray body assumption (verified here by measurements) are used to compute particle temperatures, and the average temperature is then determined by averaging the values for some 500 individual particles. Particle temperatures have been determined for various gas temperatures over a range of oxygen mole fractions from 0 to 0.2 for size-graded μm mean diameter) samples of a petroleum coke and a flash pyrolysis char. Particle burning rates per unit external surface area were determined from the measured temperatures by a heat balance analysis. The functional variation in burning rate was controlled by chemical rates (Zone I), the combined effects of chemistry and pore diffusion (Zone II), or bulk diffusion (Zone III). For the petroleum coke, both Zone I and Zone II conditions were observed, and chemical rate coefficients for each zone were derived. For the char, Zone II and a transition to Zone III conditions were observed, and a chemical rate coefficient for Zone II was derived. Reaction orders and activation energies were in the range expected from previous oxidation studies, and the chemical rates for both samples were in good agreement with previous measurements by a different method in another laboratory. The results show that careful temperature measurements can provide a sensitive method for determination of pulverized fuel burning rates. 8 figures.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 11788

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 11791, 11824, 12251, 13213

11816 **(DOE/MC/16463—1324) Appraisal of landsat lineaments as faults in western Kentucky. Final report.** Jackson, P.L. (Michigan Univ., Ann Arbor (USA). Dept. of Geological Sciences). Dec 1982. Contract AC21-81MC16463. 71p. NTIS, PC A09/MF A01. Order Number DE83005412.

Portions of document are illegible. Printed copy available until stock is exhausted.

Lineaments which resemble those produced by known, mapped geologic faults are found on Landsat images of a poprtion of Western Kentucky. Since fractures and faults are suspected to be necessary for gas production in the eastern gas shales, it would be valuable to evaluate such ineaments as faults. For this purpose surface geophysical measurements were made across the lineaments and also across mapped faults for control. Resistivity, gravity, and radiation measurements showed that the mapped faults produce geophysically measured anomalies, and also gave probable indication of faulting along two Landsat lineamants. These economical geophysical measurements are a useful, but not certain, method of evaluating Landsat lineaments as faults.

11817 **(DOE/NV/10249—3) Approximation of continuity of lenticular Mesaverde sandstone lenses, utilizing close-well correlations, Piceance Basin, northwest, Colorado. Western Gas Sands Project.** (CER Corp., Las Vegas, NV (USA)). Nov 1982. Contract AC08-82NV10249. 60p. NTIS, PC A04/MF A01. Order Number DE83004133.

Mesaverde Group sandstone units in 13 closely-spaced wells in the central and southern Piceance Basin of Colorado were correlated utilizing wireline log response quantitatively and qualitatively. Based on these correlations, the environmental subdivisions of the Mesaverde Group were characterized as follows. Paralic (upper mixed-marine) zone, occurring in the uppermost Mesaverde, includes thick sandstone units which are interpreted to be regionally continuous. Fluvial zone, containing point-bars 20 to 30+ ft thick, is interpreted to be correlatable to a maximum of 6800 ft. Paludal zone, which has insufficient data to adequately characterize the sand units. However, 63 percent of the units are correlatable across at least 139 ft. An approximation of the dimensional characteristics of Mesaverde sandstone units has potential applications in designing hydraulic fracturing treatments and estimating gas reserves more accurately. 16 figures, 2 tables

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 12014

11818 **(DOE/EIA—0131-81) Natural gas annual, 1981.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Sep 1982. 67p. NTIS, PC A04/MF A01. Order Number DE83004759.

Data are presented on the production, reserves, imports, exports, interstate movements, storage and consumption of natural gas in the USA during 1981. Marketed production accounted for 92.4% of gross withdrawals totaling 21.6 trillion ft^3. Approximately 68.6% (14.8 trillion ft^3) was processed primarily for the extraction of liquid hydrocarbons. Net dry natural gas production was 19.2 trillion ft^3. Estimated reserves, wet after lease separation, rose 1.5% to 209 trillion ft^3. The volume of natural gas in storage totaled 2.2 trillion ft^3. Imports totaled 0.9 trillion ft^3 and exports totaled 59 billion ft^3. Supplies of supplemental gaseous fuels such as SNG, propane-air, and refinery gas totaled 0.2 trillion ft^3. Total gas consumption was 19.4 trillion ft^3, down 2.4% from 1980. Average wellhead value of marketed production was $1.98 per thousand ft^3, 24.5% higher than in 1980 and 150.6% higher than in 1977. (DMC)

11819 **(UT/CES-PS—20) Incidence and effects of a windfall profit tax on natural gas.** McDonald, S.L. (Texas Univ., Austin (USA). Center for Energy Studies). Sep 1982. 40p. NTIS, PC A03/MF A01. Order Number DE83900700.

A windfall-profit tax on natural gas would have an incidence and effects similar to those of any other excise tax on a single commodity. In the short run, its burden would fall upon consumers as well as operators and royalty owners. In the long run, its burden would fall upon consumers and landowners. Its principal effect would be to contract the intensive and extensive margins of gas production and to reallocate resources at the expense of the gas industry, with the usual costs to society of artificially induced reallocations. it would lead to greater imports of oil, worsening the national-security cost of excessive dependence on insecure sources of supply. It might yield between $10 billion and $20 billion of net additional revenue to the federal treasury. Its adverse effects could be reduced by means of certain special provisions, such as the exemption of new gas, but these introduce new problems and would reduce the revenue yield. A windfall tax that falls heavily upon consumers is a poor device for dealing with the ethical problem of windfalls and major transfers between resource owners and consumers. Given the possibilities of getting revenues by means of taxes that are allocatively more neutral (such as a value-added tax) or allocatively more desirable (such as a tariff on oil imports), a windfall tax on gas must be regarded as undesirable from a general social point of view. It will make us unnecessarily worse off. Second best, perhaps, is a windfall tax exempting new gas. As for the ethical problem of windfalls, we had best rely on the automatic effects of the corporate and personal income taxes, imperfect as they are.

0308 Environmental Effects

REFER ALSO TO CITATION(S) 13027, 13080

11820 (CONF-821216—2) Human factors in Remote-Control-Engineering Task development activities. Consolidated Fuel-Reprocessing Program. Clarke, M.M.; Handel, S.J.; Draper, J.V. (Oak Ridge Associated Universities, Inc., TN (USA); Tennessee Univ., Knoxville (USA)). 1982. Contract W-7405-ENG-26. 27p. NTIS, PC A03/MF A01. Order Number DE83004652.

From Joint US/Japan Power Reactor and Nuclear Fuel Development Corporation conference; Tokyo, Japan (6 Dec 1982).

Human factors input to the Consolidated Fuel Reprocessing Program's RCE task has been accomplished in the areas of task identification, displays, control, and control station architecture and operator selection and training. Present and future efforts include time and motion study-based operating procedures, functional task allocation, large-volume viewing system definition, and integrated operator control station investigations.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 12484

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 12477

11821 (UCRL—53320) Tests of cryogenic pigs for use in liquefied gas pipelines. Hipple, D.L.; O'Neal, W.C. (Lawrence Livermore National Lab., CA (USA)). 9 Sep 1982. Contract W-7405-ENG-48. 60p. NTIS, PC A04/MF A01. Order Number DE83005028.

Pipeline pigs are a key element in the design of a proposed spill test facility whose purpose is to evaluate the hazards of large spills of liquefied gaseous fuels (LGFs). A long pipe will run from the LGF storage tanks to the spill point; to produce a rapid spill, the pipe will be filled with LGF and a pig will be pneumatically driven through the pipe to force out the LGF quickly and cleanly. Several pig designs were tested in a 6-inch-diameter, 420-foot-long pipe to evaluate their performance at liquid-nitrogen temperature and compare it with their performance at ambient temperature. For each test, the pig was placed in one end of the pipe and either water or liquid nitrogen was put into the pipe in front of the pig. Then pressurized drive gas, either nitrogen or helium, was admitted to the pipe behind the pig to push the pig and the fluid ahead of it out the exit nozzle. For some tests, the drive gas supply was shut off when the pig was part way through the pipe as a method of velocity control; in these cases, the pressurized gas trapped behind the pig continued to expand until it pushed the pig the remaining distance out of the pipe. The tests provided information on how the effectiveness and velocity of the pig and the flow rate of the expelled fluid changed with pressure and shutoff time of the drive gas and with temperature. The pig designs that left the least liquid during the water tests were a polyurethane foam pig and a cylindrical metal pig with flexible metal wipers. In the liquid nitrogen tests, the metal pig with wipers performed best. It removed all the liquid nitrogen and survived most of the tests well.

11822 (NP-tr—3900401) Suction trenching, and the use of fly ash for backfilling. Le Bouteiller, J.P.; Vanackere, Y. Translated from *Gaz d'Aujourd'hui ;* **106**: No. 4, 149-155(Apr 1982). 18p. B. Order Number DE83900401.

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The technique for suction trenching involves the use of a motor vehicle equipped to perform the following operations: ripping of road and other surfaces; trenching proper; direct removal of the extracted material by suction; waste disposal. The advantages are: single appliance serves for the complete operation; work is performed more expeditiously; site remains clean and tidy; removal of pipes is quick and easy; size of excavation is smaller than when using traditional methods. Flyash was used to backfill excavations at two sites which had previously been filled with fine sand. The material formulated consisted of fly ash, cement, an accelerator to promote setting, and water. The conclusions of this test are: hydraulic setting of the mix takes place in approximately 12 hours; cracking and contraction on setting are zero or negligible; water content of the material presents no problem. Cost analyses for suction trenching and use of fly ash are also discussed. 4 tables. (ATT)

0340 Combustion

11823 (NP-tr—3900768) Investigations and experiments by SNAM on the interchangeability of gases. Rota, G.; Beltrami, G. (CONF-8105200—1). (British Gas Corp., London). [nd]. Translated from conference on the gasification of coal: technical and economic outlook, Pugnochiuso, Italy, 28 May 1981. 44p. Dep. NTIS (US Sales Only) MF A01.

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SNAM has always been anxious about safety in operation as far as it concerns both the regularity of supplies and the quality of the gases distributed. SNAM has followed a policy of diversification of the sources of supply, tackling even uncommon technical solutions and financial commitments, as in the case of importation from Algeria, and has always opted for a distribution on network with extremely interconnected meshes. Specifications have been inserted in contracts to ensure the safety of transportation and operation. These clauses could not guarantee the constancy of quality, but only a well defined range of possible variations. Whenever it was not possible to guarantee a gas interchangeable with the gases distributed, recourse was made to conditioning before introducing it into the systems. The simultaneous distribution of natural gas and SNG has allowed us to acquire experience both in the domestic and industrial field about problems connected with the presence of hydrogen in the gases distributed. However, we have always been worried by what might happen to the users. For domestic applications we have carried out laboratory tests in order to verify the admissible range of interchangeability with the existing equipment and in the presence of irregular behavior on the part of the users, while for industrial applications we have tried to help all those users who were complaining of troubles in order to investigate technical solutions suitable for overcoming such troubles.

04 OIL SHALES AND TAR SANDS

0402 Site Geology And Hydrology

11824 (ORO—5197-15) Study of hydrocarbon: shale interaction. Progress report 315, July 1-September 30, 1979. Schettler, P.D. Jr.; Wampler, D.L. (Juniata Coll., Huntingdon, PA (USA)). 1979. Contract AS21-76ET12127. 48p. NTIS, PC A03/MF A01. Order Number DE83005521.

Portions of document are illegible.

Data and interpretations relating the physical chemistry of Devonian shale to the productivity of natural gas wells are presented in this report. Specifically, methane isotherms, helium porosity, BET, and permeability and diffusion data are presented along with a dual porosity model that takes specific account both of Poiseuille flow through a fracture network as well as diffusive flow through bulk rock. Calculations are presented for a number of fracture geometrics using average values of methane porosity and permeability.

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 12269, 12492

11825 (DOE/ET/14102—4) Synthetic fuels from US oil shales: a technical and economic verification of the HYTORT process. Final report (incorporates fourth quarterly report), January 1-March 31, 1981. (Institute of Gas Technology, Chicago, IL (USA)). Jan 1983. Contract AC20-79ET14102. 212p. NTIS, PC A10/MF A01. Order Number DE83005440.

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The objective is to fully demonstrate the technical and economic feasibility of the HYTORT process as it applies to both Eocene and Devonian shales. Achievement of this objective will widen the nation's synthetic fuels resource base by adding a new resource, Devonian shale, to the list of possible feedstocks for a synthetic fuels industry. It will also establish a high-efficiency alternative to conventional retorting of Western oil shales. Progress reports are presentef for the following five tasks of the HYTORT process development work: laboratory program; bench-scale program; process development unit tests; process environmental assessment; and process design and economics. 48 figures, 37 tables.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 11824, 12758

0408 Marketing And Economics

REFER ALSO TO CITATION(S) 11779

05 NUCLEAR FUELS

0501 Reserves

11826 **(NP—3901076) Bibliography and index of Wyoming uranium through 1973. Bulletin 61.** Banks, C.E.; Copeland, D.; Hausel, W.D. (Sunoco Energy Development Co., Dallas, TX (USA); Wyoming Geological Survey, Laramie (USA)). 1981. 137p. Wyoming Geological Survey, P.O. Box 3008, University Station, Laramie, WY 82071.

This report contains a bibliography of geological surveys conducted in Wyoming for the purpose of uranium exploration. Some reports on those parts of the southern Black Hills of South Dakota have been included since they describe the Inyan Kara Group rocks which continue directly into northeast Wyoming. All useful material published during the postwar period through 1973 is included. (DMC)

0502 Exploration

11827 **(GJBX—21-82) National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California.** (Oak Ridge National Lab., TN (USA)). 15 Oct 1981. Contract W-7405-ENG-26. 176p. (K/UR—402). D. Order Number DE82007138.

Includes 1 sheet of 48x reduction microfiche. Portions of document are illegible.

Field and laboratory data are presented for 1890 sediment samples from the Sacramento Quadrangle, California. The samples were collected by Savannah River Laboratory; laboratory analysis and data reporting were performed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

11828 **(GJBX—24-82) National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 Oct 1981. Contract W-7405-ENG-26. 119p. (K/UR—407). D. Order Number DE82007139.

Includes 1 sheet of 48x reduction microfiche. Portions of document are illegible.

Field and laboratory data are presented for 1038 sediment samples from the Fresno Quadrangle, California. The samples were collected by Savannah River Laboratory; laboratory analysis and data reporting were perfomed by the Uranium Resource Evaluation Project at Oak Ridge, Tennessee.

11829 **(GJBX—25-82) Evaluation of uranium geochemical anomalies in the Charlotte 1° x 2° NTMS quadrangle.** Carpenter, R.H. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Nov 1981. Contract AC13-76GJ01664. 30p. (DPST—81-141-4). NTIS, PC A03/MF A01. Order Number DE82010053.

Portions of document are illegible.

The Savannah River Laboratory was involved in the National Uranium Resource Evaluation program from 1974 through 1981. The SRL role was to design, conduct, and report the data from a geochemical reconnaissance of almost half the continental United States. The purpose of this work was to provide a basis for evaluating the uranium potential of areas and to identify areas meriting conventional geologic followup. In this program, over 275,000 samples of stream sediment, soil, vegetation, and ground or surface water were collected. This report summarizes the results of a small study in the Charlotte 1° x 2° quadrangle. Compared to surrounding country rocks, granitic rocks near the eastern boundary of the Charlotte Belt in Rowan and Cabarrus Counties are significantly enriched in uranium, thorium, and potassium. Consequently, they yielded distinctive gross-gamma aeroradioactivity anomalies. No definite evidence for significant uranium mineralization is indicated; the highest concentration calculated from the field measurements is only 28 ppM. Ten times this amount would probably be required for serious interest in commercial exploitation. However, several areas are judged to be worthy of further investigation on the basis of unusual geochemical conditions and aeroradiometric anomalies. These are listed below together with proposed followup procedures and time allotments. 1. Detailed ground radiometric survey of the Heglar Prospect and associated aeroradiometric anomaly (2 days). 2. Detailed ground radiometric survey of the northeastern portion of the Bogers Chapel pluton (2 days). 3. Ground radiometric measurements at a number of quarry sites in the Salisbury pluton (1 day).

11830 **(GJBX—165-82) Hydrogeochemical and stream-sediment reconnaissance basic data for Phoenix quadrangle, Arizona. Uranium Resource Evaluation Project.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 Nov 1982. Contract AC13-76GJ01664. 7p. (K/UR—445). NTIS (US Sales Only). Order Number DE83004487.

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Hydrogeochemical data are compiled for ground water and surface water of the Phoeniz quadrangle in Arizona. (ATT)

11831 **(GJBX—166-82) Hydrogeochemical and stream-sediment reconnaissance basic data for San Luis Obispo and Santa Cruz Quadrangles, California.** (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 10 Nov 1982. Contract AC13-76GJ01664. 73p. (K/UR—446). NTIS, PC A04/MF A01. Order Number DE83004486.

Portions of document are illegible.

Hydrogeochemical data are compiled for ground water and surface water of San Luis Obispo and Santa Cruz quadrangles in California. (ATT)

11832 **(GJBX—167-82) Hydrogeochemical and stream-sediment reconnaissance basic data for Fresno and Death Valley quadrangles, California; Nevada. Uranium Resource Evaluation Project.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 15 Nov 1982. Contract AC13-76GJ01664. 63p. (K/UR—447). NTIS (US Sales Only). Order Number DE83004484.

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Hydrogeochemical data are compiled for surface water and ground water of the Fresno and Death Valley quadrangles in California and Nevada. (ATT)

11833 **(GJBX—169-82) Hydrogeochemical and stream-sediment reconnaissance basic data for Caliente, Lund, Ely, and Elko Quadrangles, Nevada; Utah.** (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 22 Nov 1982. Contract AC13-76GJ01664. 59p. (K/UR—458). NTIS, PC A04/MF A01. Order Number DE83003513.

Portions of document are illegible.

Hydrogeochemical data are compiled for ground water and surface water of Caliente, Lund, Ely, and Elko quadrangles of Nevada and Utah. (ATT)

11834 **(GJBX—170-82) Hydrogeochemical and stream-sediment reconnaissance basic data for Adel, Jordan Valley, and Twin Falls quadrangles, Oregon; Idaho. Uranium Resource Evaluation Project.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 18 Nov 1982. Contract AC13-76GJ01664. 71p. (K/UR—450). NTIS (US Sales Only). Order Number DE83004554.

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Hydrogeochemical data are compiled for ground water and surface water of Adel, Jordan Valley, and Twin Falls quadrangles of Oregon and Idaho. (ATT)

11835 **(GJBX—172-82) Hydrogeochemical and stream-sediment reconnaissance basic data for Hailey and Challis Quadrangles, Idaho.** (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 18 Nov 1982. Contract AC13-76GJ01664. 67p. (K/UR—452). NTIS (US Sales Only). Order Number DE83004482.

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Hydrogeochemical data are compiled for ground water and surface water for the Hailey and Challis quadrangles in Idaho. (ATT)

11836 **(GJBX—173-82) Hydrogeochemical and stream-sediment reconnaissance basic data for Idaho Falls quadrangle, Idaho. Uranium Resource Evaluation Project.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 9 Nov 1982. Contract AC13-76GJ01664. 46p. (K/UR—453). NTIS (US Sales Only). Order Number DE83004529.

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Hydrogeochemical data are compiled for ground water and surface water of the Idaho Falls quadrangle in Idaho. (ATT)

11837 **(GJBX—177-82) Hydrochemical and stream sediment detailed geochemical survey for Kettle Falls and Midnite Mine Areas, Washington.** (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 3 Dec 1982. Contract W-7405-ENG-26. 58p. (K/UR—457). NTIS, PC A04. Order Number DE83004564.

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Hydrochemical data are compiled for surface water and ground water of the Kettle Falls and Midnite Mine Areas in Washington. (ATT)

11838 **(GJBX—196-82-Vol.1) Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). [nd]. Contract AC13-79GJ01692. 95p. NTIS PCE09/MF $12.00. Order Number DE83003409.

Portions of document are illegible. Includes 36 sheets of 48x reduction microfiche.

An airborne combined radiometric and magnetic survey was performed over the Buckshot Detail Area of southwestern Texas. Data were collected by a helicopter equipped with a gamma-ray spectrometer with a large crystal volume, and with a high sensitivity proton precession magnetometer. The radiometric system was calibrated at the Walker Field Calibration pads and the Lake Mead Dynamic Test Range. Data quality was ensured during the survey by daily test flights and equipment checks. Radiometric data were corrected for live time, aircraft and equipment background, cosmic background, atmospheric radon, Compton scatter, and altitude dependence. The corrected data were statistically evaluated, gridded, and contoured to produce maps of the radiometric variables, uranium, potassium, and thorium; their ratios; and the residual magnetic field. These maps have been analyzed in order to produce a multivariant analysis contour map based on the radiometric response of the individual geological units. A geochemical analysis has been performed, using the radiometric and magnetic contour maps, the multi-variant analysis maps, and factor analysis techniques, to produce a geochemical analysis map for the are. Volume I contains a description of the systems used in the survey, a discussion of the calibration of the systems, the data collection procedures, the data processing procedures, the data presentation, the interpretation rationale, and the interpretation methodology. Separate Volumes II-A, II-B, II-C, and II-D contain the data displays and the interpretation results for the project area.

11839 **(GJBX—196-82-Vol.2A) Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1982. Contract AC13-79GJ01692. 1404p. NTIS, PC A99/MF A01. Order Number DE83002700.

Portions of document are illegible.

An airborne combined radiometric and magnetic survey were performed over the Buckshot Detail Area of southwestern Texas. Volume I contains a description of the systems used in the survey, a discussion of the calibration of the systems, the data collection procedures, the data processing procedures, the data presentation, the interpretation rationale, and the interpretation methodology. Separate Volumes II-A, II-B, II-C, and II-D contain the data displays and the interpretation results for the project area. Contents of Volume II-A are as follows: geology; radioactive mineral occurrences in Texas; geophysical data interpretation; references; appendices for stacked radiometric profiles and for magnetic and ancillary profiles. 2 figures, 2 tables.

11840 **(GJBX—196-82-Vol.2B) Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1982. Contract AC13-79GJ01692. 359p. NTIS (US Sales Only). Order Number DE83002701.

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An airborne combined radiometric and magnetic survey was performed over the Buckshot Detail Area of southwestern Texas. Volume I contains a description of the systems used in the survey, a discussion of the calibration of the systems, the data collection procedures, the data processing procedures, the data presentation, the interpretation rationale, and the interpretation methodology. Separate Volumes II-A, II-B, II-C, and II-D contain the data displays and the interpretation results for the project area. Contents of Volume II-B are appendices for the following: geologic histograms; geochemical histograms; speed and altitude histrograms; geologic statistical tables; geochemical statistical tables; and test line data. (ATT)

11841 **(GJBX—196-82-Vol.2C) Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1982. Contract AC13-79GJ01692. 305p. NTIS, PC A14/MF A01. Order Number DE83002726.

Portions of document are illegible.

An airborne combined radiometric and magnetic survey were performed over the Buckshot Detail Area of southwestern Texas. Volume I contains a description of the systems used in the survey, a discussion of the calibration of the systems, the data collection procedures, the data processing procedures, the data presentation, the interpretation rationale, and the interpretation methodology. Separate Volumes II-A, II-B, II-C, and II-D contain the data displays and the interpretation results for the project area. Volume II-C contains the following: flight line maps; geology maps; explanation of geologic legend; flight line/geology maps; and geochemical factor analysis maps. (ATT)

11842 **(GJBX—196-82-Vol.2D) Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area.** (High Life Helicopters, Inc., Puyallup, WA (USA); QEB, Inc., Lakewood, CO (USA)). 1982. Contract AC13-79GJ01692. 536p. NTIS, PC A23/MF A01. Order Number DE83002724.

Portions of document are illegible.

An airborne combined radiometric and magnetic survey were performed over the Buckshot Detail Area of southwestern Texas. Volume I contains a description of the systems used in the survey, a discussion of the calibration of the systems, the data col-

lection procedures, the data processing procedures, the data presentation, the interpretation rationale, and the interpretation methodology. Separate Volumes II-A, II-B, II-C, and II-D contain the data displays and the interpretation results for the project area. Volume II-D contains appendices for the following: radiometric contour maps; magnetic contour maps; and multi-variant analysis maps. (ATT)

0503 Mining

REFER ALSO TO CITATION(S) 13091, 13170

0504 Feed Processing

REFER ALSO TO CITATION(S) 11941

0505 Enrichment

REFER ALSO TO CITATION(S) 11921, 11938

11843 **(KFK—3332) Importance of radiolytic decomposition of uranium hexafluoride in the course of uranium-235 enrichment under the separation nozzle method.** Becker, E.W.; Bier, W.; Hagmann, P.; Mikosch, F. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernverfahrenstechnik; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau). Apr 1982. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750923.

In U-235 enrichment under the separation nozzle method gaseous uranium hexafluoride is used in a mixture with H_2 or He. To predict the longterm behavior of the separation elements the question was of interest whether the radioactive radiation of uranium causes UF_6 to undergo significant decomposition while forming solid uranium compounds. In the operation of an apparatus in which the ratio of uranium inventory to slit length of the separation elements was greater by several orders of magnitude than in a commercial scale separation nozzle stage, significant depositions of dusty uranium compounds in the separation element were observed already after one day. Within the limits of error, the effect was independent of the kind of auxiliary gas used. In case of helium, dust deposition could be avoided by addition of not more than 0.06 mol% of F_2. Careful elimination of all other possible dust sources and an estimate of the conceivable radiation effect permit to conclude that the dust results from the radiolytic decomposition of UF_6. Dust deposition in the separation element greatly depends on the mean residence time of UF_6 in the reservoir. The importance ofthe residence time can be explained by the fact that this parameter determines the degree of agglomeration, i.e., the particle size of the dust produced and that the line connecting the reservoir with the separation nozzle system acts as a filter whose efficiency is dependent on the particle size. From an analysis of the transport processes and from corresponding experiments it can be expected that a filter with a low pressure drop will keep away all solid products resulting from radiolytic decomposition of UF_6 from the separation elements of a commercial separation nozzle stage.

11844 **Finite element method for the Onsager pancake equation.** Gunzburger, M.D. (Univ. of Tennessee, Knoxville); Wood, H.G. III. *Computer Methods in Applied Mechanics and Engineering;* **31**: No. 1, 43-59(Jul 1982). Contract W-7405-ENG-26.

Finite element methods for the approximate solution of the Onsager pancake equation are considered. This equation models the flow of a gas in a rapidly rotating centrifuge. A full description of two algorithms is given. To show the viability of these methods, two numerical examples are presented, one for flow driven by a linear temperature gradient along the wall of the centrifuge, and the other for flow driven by axial mass fluxes through the end caps of the centrifuge.

11845 **Multipass batch-step advanced isotope separation campaign models.** Pendergrass, J.H. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **41**: 140-141(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

0506 By-products

REFER ALSO TO CITATION(S) 11951

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 11865, 11937, 11941, 12356, 12357, 12718, 12824

11846 **Shock-compression parameters for uranium dioxide from 5 to 330 GPa.** Gust, W.H. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Journal of Nuclear Materials;* **107**: No. 2/3, 290-296(Jun 1982).

Calculations related to liquid metal, fast-breeder-reactor, excursion analyses based on extrapolations of published Hugoniot data for UO_2 are in serious error because the experimental techniques used to obtain the data did not resolve the strong multiple-wave shock structures present. We have used the inclined prism, flash gap, and two-stage gas-gun techniques to determine shock-compression parameters for UO_2 up to 330 GPa. The Hugoniot elastic limit for UO_2 was found to be 5.7 GPa. The low-pressure shock velocity, Usub(s), can be described in terms of particle velocity, Usub(p), by Usub(s) = 3.88 + 1.11 (Usub(P)-0.3) for $0.3 < Usub(p) < 1.05$ km s^{-1}. At hih pressure, a plot of shock versus particle velocity displays a discontinuity between $1.05 < Usub(P) < 1.8$ km s^{-1}, which appears to be a manifestation of a solid-solid phase transition. For $1.8 < Usub(P) < 4.0$ km s^{-1}, the plot is given by Usub(s) = 5.8 +- 1.28 (Up - 1.8). This curve differs substantially from those previously reported.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 11938, 12771, 12839, 12841, 12842, 12866

11847 **(CONF-811108—21-Draft) Nuclear-fuel-cycle costs. Consolidated Fuel-Reprocessing Program.** Burch, W.D.; Haire, M.J.; Rainey, R.H. (Oak Ridge National Lab., TN (USA); Oak Ridge Associated Universities, Inc., TN (USA)). 1981. Contract W-7405-ENG-26. 10p. NTIS, PC A02/MF A01. Order Number DE83003411.

From Annual meeting of the Institute of Chemical Engineers; New Orleans, LA, USA (8 Nov 1981).

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The costs for the back-end of the nuclear fuel cycle, which were developed as part of the Nonproliferation Alternative Systems Assessment Program (NASAP), are presented. Total fuel-cycle costs are given for the pressurized-water reactor once-through and fuel-recycle systems, and for the liquid-metal fast-breeder-reactor system. These calculations show that fuel-cycle costs are a small part of the total power costs. For breeder reactors, fuel-cycle costs are about half that of the present once-through system. The total power cost of the breeder-reactor system is greater than that of light-water reactor at today's prices for uranium and enrichment.

11848 **(ORNL/TM—8483) Evaluation of a heat exchanger for use in the Integrated Equipment Test facility solvent-extraction system.** Lewis, B.E. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 22p. NTIS, PC A02/MF A01. Order Number DE83005174.

The primary decontamination extraction section product (HAP) heat exchanger will be located between the extracting section (HA) and scrubbing section (HS) of centrifugal solvent extraction contactors in the Integrated Equipment Test (IET) facility. The heat exchanger is required to raise the temperature of the organic product stream from the HA contactor from 40 to 50°C.

Tests were conducted under prototypic IET operating conditions to determine the head requirements for gravity flow and the overall heat transfer coefficient for the heat exchanger. Results from the tests indicated that the specified heat exchanger would perform satisfactorily under normal operating conditions.

11849 **APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste.** Steinberg, M.; Powell, J.R. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **41**: 123-125(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

0509 Transport And Storage

REFER ALSO TO CITATION(S) 11874, 11875, 11904, 11913, 11932, 12863

11850 **(DOE/ET/47916—1-Vol.4) Transportation of radioactive materials. Volume IV. Executive summaries.** (Southern States Energy Board, Atlanta, GA (USA)). Mar 1982. Contract AC09-80ET47916. 21p. NTIS, PC A02/MF A01. Order Number DE83003869.

The objective of the institutional issues report is to identify current requirements and ongoing programs that apply to the transportion of radioactive materials in the Southeastern United States. States included within the scope of this study are : Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia and the Commonwealth of Puerto Rico. Included in this study is a summary of the scope of present transportation activity, current disposal options for radioactive waste, the cost of transporting radioactive material, and transportation accidents and incidents that have occurred. Legislative and regulatory programs that have been developed by federal, state and local authorities are also summarized. Additionally, institutional and regulatory trends that may affect the transportation of radioactive materials are identified. The reporting and monitoring project had the following objectives: (1) evaluating sources of information to track the movement of significant radioactive material shipments throughout the southern region; (2) conceptualizing a uniform interstate method to provide location information; and (3) assessing the feasibility of establishing a regional reporting and monitoring procedure. The response plans report summarizes the efforts conducted for Project 3 which concerned itself with Emergency Response to Transportation Accidents Involving Radioactive Materials.

11851 **(DOE/LLW—15T) 1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites.** (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1982. Contract AC07-76ID01570. 115p. NTIS, PC A06/MF A01. Order Number DE83005161.

This state-by-state report again uses the volume of low-level waste reported as received at each commercial disposal site as the nation baseline figure. A volume of 87,789 m^3 of radioactive waste containing 279,863 Ci of activity was reported disposed at the commercial sites in 1981. The distribution of these waste volumes by disposal site is presented in Table 1 and a summary of estimated volumes by generator categories is contained in Table 2. The total volume and curie values tabulated for each state were obtained directly from the commercial disposal site operators. Summary information on commercial nuclear power plant wastes was obtained from semiannual waste reports submitted to the NRC in accordance with the NRC Regulatory Guide 1.21. Data reported for the calendar year 1981 were used for this report where available. When report data were not available reactor information was obtained directly from the utility. The reported quantities of solid radioactive wastes generated by government installations shipped to commercial disposal sites are annually summarized in the SWIMS report. Records of radioactive wastes shippped to commercial disposal sites from the US Navy nuclear-powered ships and support facilities are maintained by the Nuclear Power Directorate, Naval Sea Systems Command, Department of the Navy, and are reported on an annual basis. Available information from other military departments such as the Army and the Air Force were included in this study. Wastes from these other military commands do not constitute a significant volume of radioactive source.

11852 **(SAND—80-1943) RADTRAN II: revised computer code to analyze transportation of radioactive material.** Taylor, J.M.; Daniel, S.L. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 90p. (TTC—0239). NTIS, PC A05/MF A01. Order Number DE83005199.

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A revised and updated version of the RADTRAN computer code is presented. This code has the capability to predict the radiological impacts associated with specific schemes of radioactive material shipments and mode specific transport variables.

11853 **(SAND—82-7066) Truck accident and fatality rates calculated from California highway accident statistics for 1980 and 1981.** Smith, R.N.; Wilmot, E.L. (Sandia National Labs., Albuquerque, NM (USA); California State Dept. of Transportation, Sacramento (USA)). Nov 1982. Contract AC04-76DP00789. 72p. (TTC—0325). NTIS, PC A04. Order Number DE83004998.

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California state highway accident rates for three types of truck vehicles (pickup, truck without trailer, and truck with trailer) were analyzed for 1980 and 1981 and for various road types in each of eleven state highway districts. Accident rates have not been available previously that are specific to truck vehicles, particularly truck with trailer. Reported data are presented that lead to several significant observations about truck accident rates: pickup truck accident rates are about twice the composite rates for all vehicle types; the fatality rates for trucks with trailer are nearly twice that for all vehicle types; fatality rates for trucks (without trailer) are comparable to the composite rates; and total accident and fatal-plus-injury rates for trucks with trailer are close to the composite rates in urban areas but higher in rural areas. The values for average total accident rates reported in 1981 are: 2.2 accidents per million vehicle miles (mvm) for pickups, 1.5 accidents per mvm for trucks, and 1.4 accidents per mvm for trucks with trailer. The values for average fatality rates reported in 1981 are: 3.8 fatalities per 100 mvm for pickups, 2.8 fatalities per 100 mvm for trucks, and 4.3 fatalities per 100 mvm for trucks with trailer. The reported rates for 1980 are approximately the same.

11854 **(UCRL—88254) Experimental and calculational results from the Spent Fuel Test-Climax.** Patrick, W.C.; Ramspott, L.D.; Ballou, L.B. (Lawrence Livermore National Lab., CA (USA)). 14 Oct 1982. Contract W-7405-ENG-48. 14p. (CONF-8210101—2). NTIS, PC A02/MF A01. Order Number DE83004217.

From Workshop on in site experiments in granite associated with geological disposal of radioactive waste; Stockholm, Sweden (25 Oct 1982).

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The Spent Fuel Test-Climax (SFT-C) is being conducted under the technical direction of the Lawrence Livermore National Laboratory for the US Department of Energy. The SFT-C is located 420 m below surface in the Climax placed in test storage in April and May 1980. At the same time, 6 electrical elevated-temperature phase of the test. Data related to heat transfer, thermomechanical response, radiation dose, and radiation damage have been collected and are presented here, as appropriate, with calculational results. In general, measured and calculated results compare well.

11855 **Evaluations of alternatives for on-site spent fuel storage.** Hook, K.A.; Prend, D.J.; Sandberg, R.O. (Bechtel National, Inc., P.O. Box 3965, San Francisco, CA 94119). *Transactions of the American Nuclear Society;* **41**: 143-144(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

11856 Background and historical perspectives for monitored retrievable storage. Vieth, D.L.; Stein, R. (U.S. Department of Energy, Washington, DC 20545). *Transactions of the American Nuclear Society;* **41**: 126(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

11857 Screening for monitored retrievable storage facility locations. Kirkwood, C.W.; Ko, S.C. (Woodward-Clyde Consultants, Three Embarcadero Center, Suite 700, San Francisco, CA 94111). *Transactions of the American Nuclear Society;* **41**: 126-127(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

11858 Economics of monitored retrievable storage of nuclear wastes. Morissette, R.P. (General Atomic Company, P.O. Box 81608, San Diego, CA 92138). *Transactions of the American Nuclear Society;* **41**: 127-129(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

11859 Conceptual design of monitored retrievable storage facilities. Wilde, R.T. (Rockwell Hanford Operations, P.O. Box 800, Richland, WA 99352). *Transactions of the American Nuclear Society;* **41**: 129-130(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

11860 Fuel powder transport through container leaks. Owzarski, P.C.; Johnston, J.W.; Mishima, J.; Schwendiman, L.C.; Sutter, S.L. (BNWL, Richland, WA 99352). *Transactions of the American Nuclear Society;* **35**: 106-107(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

11861 Structural analysis of the TRUPACT contact-handled Transuranic waste transporter. Lamoreaux, G.H.; Duffey, T.A.; Pope, R.B.; Sutherland, S.H. (Sandia Natl Labs, Albuquerque, NM 87115). *Transactions of the American Nuclear Society;* **35**: 107-108(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

11862 Subjecting spent-fuel shipments to extreme environments. Sandoval, R.P.; Luna, R.E. (Sandia Natl Labs, Albuquerque, NM 87115). *Transactions of the American Nuclear Society;* **35**: 108-109(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 11847

0520 Waste Management

REFER ALSO TO CITATION(S) 11849, 11851, 11854, 11856, 11857, 11858, 11859, 11922, 11923, 11924, 11925, 11926, 11933, 11947, 12394, 12686, 12688, 12740, 12762, 12771, 12825, 12859, 13157, 13200, 13214, 13219

11863 (AERE-R—10516) Objectives for radioactive waste packaging. Flowers, R.H. (UKAEA Authority Fuel Processing Directorate). Apr 1982. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703059.

The report falls under the headings: introduction; the nature of radioactive wastes; how to manage radioactive wastes; packaging of radioactive wastes (supervised storage; disposal); waste form evaluation and test requirements (supervised storage; disposal); conclusions.

11864 (CEA-CONF—6241) French status of high level radioactive wastes solidification. Sombret, C. (CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (France)). Apr 1982. 11p. (CONF-820424—34). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703060.

From ANS topical meeting on treatment and handling of radioactive wastes; Richland, WA, USA (19 Apr 1982).

Research and development carried out in France for a long time about solidification of high level radioactive wastes have been mainly directed toward the glassy state. Investigations about borosilicates lead up to choose glass as a final form for the fission products solutions stored in both reprocessing plants. Works related to various techniques to make use of this type of material started also a long time ago. A two steps continuous process was selected owing to satisfactory results rised from a long term prototype running with respects to the glass manufacturing as well as the remotely handling ability. AVM, the Marcoule Vitrification Plant has been running since 1978. Further Vitrification Plants related to the La Hague reprocessing plant are under design.

11865 (CEA-CONF—6259) Plutonium fuel fabrication residues and wastes. Arnal, T.; Cousinou, G.; Desille, H. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Apr 1982. 6p. (CONF-820420—10). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703058.

From International ENS/ANS conference on nuclear energy with emphasis on fuel cycles; Brussels, Belgium (26 Apr 1982).

This paper discusses the current situation in the fabrication plant at Cadarache with an annual plutonium throughput of several tons. Three major fabrication byproduct categories are defined in this plant: 1) scraps, directly recycled at the fabrication input station; 2) residues, byproducts recycled by chemical processes, or processed in washing and incineration stations; 3) wastes, placed in drums and evacuated directly to a waste conditioning station. The borderline between residues and wastes has yet to be precisely determined.

11866 (CONF-821107—30) Strontium leachability of hydrofracture grouts for sludge-slurries. Morgan, M.T.; McDaniel, E.W.; Moore, J.G.; Devaney, H.E.; Dole, L.R. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE83003453.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

A series of experiments to determine the strontium leachability of cement-based sludge-slurry hydrofracture grouts is summarized. The hydrofracture process has been used at ORNL since 1966 for the routine disposal of intermediate-level waste (ILW) solutions. In this process, cement and other additives are mixed with a waste stream to form grout, which is then injected into a shale bed at a pressure sufficient to cause fracturing along the horizontal bedding planes. This injected grout soon hardens, fixing the radionuclides between layers of the massive Conasauga shale formation. Modified IAEA dynamic leach tests on hydrofracture grout specimens showed improved leach resistance (by a factor of 3 to 5) as the curing time increased from 28 d to 91 d. A weak trend toward lower leachability with increased amounts of dry solids was observed. The moving boundary-plus-diffusion leach model fits the dynamic leach data successfully in most cases. An apparent diffusion coefficient of 5×10^{-12} cm^3/s and a moving boundary coefficient of 1×10^{-7} s^{-1} were obtained when one of the best grout compositions was leached in distilled water. Assuming that vertical fractures produce the leachable surfaces in a grout sheet, the release rate of strontium calculated with these coefficients is well below the NRC maximum of 10^{-5} fraction per year.

11867 (CONF-821107—33) Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance. Sales, B.C.; Petek, M.; Boatner, L.A. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE83003419.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

Measurements of the electrical conductivity of leachate solutions as a function of time can be used as an efficient, informative means of evaluation and comparison in the development of nuclear waste forms and in the preliminary analysis of their corrosion resistance in distilled water. Three separate applications of this technique are described in this work. These are: (1) its use in the optimization of the corrosion resistance of a crystalline wasteform (monazite); (2) a study of the protective ability of the surface layer (gel layer) which forms on the nuclear waste glass Frit 21 + 20 wt % SRW in distilled water; and (3) making comparisons of the overall corrosion resistance of three different nuclear wasteforms (i.e., monazite, SYNROC, and borosilicate glass). A complete solution analysis of the borosilicate glass leachate and a straightforward analysis of the conductivity results agree to within +-20%. In the absence of a complete, time consuming solution analysis, conductivity measurements can be used to estimate reliably the total ionic concentration in the leachate to within a factor of 2.

11868 **(DOE/LLW—6T) Directions in low-level radioactive-waste management.** (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1982. Contract AC07-76ID01570. 67p. NTIS, PC A04/MF A01. Order Number DE83003145.

Three individual reports are indexed separately. They cover planning state policy on low-level radioactive waste, incentives and compensation for communities hosting low-level waste facilities, and three commercial waste facilities no longer operating.

11869 (DOE/LLW—6T, pp 15p, Paper 1) **Planning state policy on low-level radioactive waste.** Oct 1982. NTIS, PC A04/MF A01. Contract AC07-76ID01570.

In Directions in low-level radioactive-waste management.

The majority of states face a growing problem in the management of low-level radioactive waste generated within their borders. The current uncertainty regarding the availability of disposal sites for these waste products exacerbates their increasing generation rate. The purpose of this publication is to assist state governments in planning effective policy to address these problems. Background information is presented on the current situation, the responsibilities of state government, and the assistance available to states from federal agencies and national groups. The document then focuses on state policy planning, including: (a) methodology for assessing a state's current waste management status and for projecting future needs, (b) consideration of waste management options for a state, and (c) insight into the possible effects and implications of planned policies. This information is intended primarily for state officials - executive, legislative, and agency - and does not include detailed technical information on waste characteristics or handling techniques.

11870 (DOE/LLW—6T, pp 10p, Paper 2) **Incentives and compensation: providing resources for communities hosting low-level waste facilities.** Oct 1982. NTIS, PC A04/MF A01. Contract AC07-76ID01570.

In Directions in low-level radioactive-waste management.

State responsibility for the management of low-level radioactive waste necessitates the selection of candidate locations for a disposal facility. Concern over potential impacts can be expected from segments of the citizenry neighboring a proposed site. A number of national organizations comprising state and local officials have recommended the use of incentives and compensation to help offset the negative local impacts. This document explores that concept. Discussion provides background information on potential local impacts from a low-level waste facility and considers the nature and types of incentives and compensation benefits that could be provided. The document then examines realistic options for planning and implementing the benefit program. This information is intended, primarily, to assist state officials - executive, legislative, and agency - in planning for and managing low-level waste disposal facilities.

11871 (DOE/LLW—6T, pp 24 p, Paper 3) **Low-level radioactive waste disposal: commercial facilities no longer operating.** Berlin, R.E.; Tuite, P.T. (Waste Management Group, Inc., White Plains, NY). Oct 1982. NTIS, PC A04/MF A01. Contract AC07-76ID01570.

In Directions in low-level radioactive waste management.

This publication discusses three commercial facilities - no longer operating - that have received and now contain low-level radioactive waste. The facilities are located at West Valley, New York; Maxey Flats, Kentucky; and Sheffield, Illinois. All three of the facilities were selected and developed in the 1960s. The onset of water management problems caused the closure of the sites at West Valley and Maxey Flats in 1975 and 1977, respectively. Closure of the Sheffield site occurred in 1978, after the operator experienced site problems and consequent lengthy delays in its license renewal procedures. The document provides detailed explanation of the history, basis for closure, and current status of each facility. This information is intended, primarily, to assist state officials - executive, legislative, and agency - in planning for, establishing, and managing low-level waste disposal facilities.

11872 **(DOE/LLW—12T) Radioactive-waste incineration at Purdue University.** (Purdue Univ., Lafayette, IN (USA). School of Health Sciences). Nov 1982. Contract AC07-76ID01570. 49p. NTIS, PC A04/MF A01. Order Number DE83003314.

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A study conducted at Purdue University to evaluate the feasibility of using a small (45 kg/h), inexpensive (less than $10K) incinerator for incinerating low-level radioactive waste is described. An oil-fired, dual-chamber pathological waste incinerator was installed on a 12.7-cm-thick concrete floor in a metal quonset building. A standard EPA Method 5 sampling train was used to obtain stack samples. Also, stack gas velocity was measured with a type 5 pitot tube; stack temperature was measured with a thermocouple and pyrometer. The incinerator was tested for emissions from incineration of laboratory animal carcasses, liquid scintillation fluid, and trash. Emissions measured were particulates, SO/sub x/, NO/sub x/, Cl, CO, CO_2, H_2O, and unburned hydrocarbons in the particulate fraction. Three analyses were then averaged to arrive at the final determinations. Results of the study demonstrated the feasibility and cost-effectiveness of incinerating radioactive animal carcasses and liquid scintillation fluids, since emissions from those waste types were within EPA and State of Indiana limits. However, emissions from burning of trash exceeded State of Indiana limits. Therefore, incineration of trash alone, particularly if it contains glass or significant amounts of plastic, is not a recommended use of the tested equipment.

11873 **(DOE/NV/00410—68) Comparative assessment of disposal of TRU waste in a greater-confinement disposal facility.** Cohn, J.J.; Smith, C.F.; Ciminesi, F.J.; Dickman, P.T.; O'Neal, D.A. (Science Applications, Inc., Pleasanton, CA (USA); Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)). Nov 1982. Contract AC08-76NV00410. 87p. NTIS, PC A05/MF A01. Order Number DE83005242.

This study reviewed previous work that established generic limits for shallow land burial of TRU contaminated wastes and extended previous methodology to estimate approximate appropriate burial limits for TRU wastes in an arid zone greater confinement disposal facility (GCDF). An erosion scenario provided the limiting pathway in the previous determination of generic shallow land burial limits. Erosion removed the cover soil, exposing the waste mass to habitation and agriculture. For the deep burial concept (that is, burial at a depth greater than 10 m [33 ft]), the aquifer transport scenario was controlling. In both cases, the assumed site conditions were characteristic of a humid zone in which groundwater flows immediately below the waste deposit. In deriving limits for an arid site GCDF, either the erosion/reclaimer or the aquifer transport scenario could provide the controlling pathway, depending on the nuclide and the assumed burial depth. The derived limits were higher for the arid sited GCDF than those of the generic humid study. The physical processes that increase limits relative to the generic study include increased time during which radioactive decay occurs prior to release and increased dilution. Some nuclides were effectively unlimited in an arid zone GCDF, while others (notably Pu-239) were affected on a much smaller scale, primarily due to very long half-lives. As a final comment, the limit values derived in this report represent adjustments to the calculations of the Healy

and Rodgers report (LA-UR-79-100). Those original calculations were very conservative, utilizing a worst case approach, but nevertheless involving significant levels of uncertainty in key assumptions. Consequently, the results are assumption dependent. Other approaches to such an analysis could, and should be used to develop site specific concentration limits for TRU wastes.

11874 **(DOE/NV/10250—4) Commercial nuclear-waste research and development program. Quarterly report, July-September 1982.** Hakl, A.R. (Westinghouse Electric Corp., Mercury, NV (USA). Advanced Energy Systems Div.). Oct 1982. Contract AC08-82NV10250. 34p. NTIS, PC A03/MF A01. Order Number DE83004754.

This document is a report of activities during the fourth quarter of FY-1982 to meet task objectives of the Nevada Nuclear Waste Storage Investigations FY-1982 Project Plan. Noteworthy accomplishments were: The second Climas fuel exchange of FY 1982 was completed. Source evaluation of the bidders was completed. The contract for glass refurbishment and window fabrication for the East Process Cell is being negotiated. All canister gas samples scheduled for FY 1982 were taken and analyzed; no ^{85}K was detected. Fuel assembly B-02 was removed from the Surface Storage Cask (SSC) in preparation for fuel and canister contamination surveys and subsequent placement in the fuel temperature test. This event terminated a four year demonstration of dry interim storage of a sealed canister containing spent nuclear fuel in an above ground surface storage cask. The data acquisition systems which were damaged by lightning were repaired and returned to operation. The draft report for Task 13, Documentation of E-MAD Spent Fuel Assembly Histories and Predictions of Peak Clad Temperatures, was completed and transmitted to DOE and PNL for review. Twenty-one tours were conducted for 312 visitors to the E-MAD Facility, including the governor of Utah and his staff.

11875 **(DOE/NV/10250—5) Commercial nuclear waste research and development program. Annual report, fiscal year 1982.** Hakl, A.R. (Westinghouse Electric Corp., Mercury, NV (USA). Advanced Energy Systems Div.). Oct 1982. Contract AC08-82NV10250. 55p. NTIS, PC A04/MF A01. Order Number DE83004770.

This document is a report of FY 1982 activities performed to meet task objectives of the Nevada Nuclear Waste Storage Investigations (NNWSI) FY-1982 Project Plan. Noteworthy accomplishments were: Fuel assembly B-02 was removed from the surface Storage Cask (SSC) after four years of testing, and placed in lag storage in preparation for contamination surveys and the subsequent Fuel Temperature Test. A draft report was prepared which documents histories of all fuel assemblies while in the custody of AESD-Nevada Operations. Canister gas samples were acquired from seven fueled canisters to determine the presence of ^{85}Kr, which would indicate fuel pin leakage. No ^{85}Kr was detected in any of the samples. Two spent fuel assembly exchange operations were completed in support of the Spent Fuel Test - Climas. Fixtures have been designed and fabricated for handling canisters during fuel assembly/canister contamination examinations, and for holding and vibrating canisters to remove loose debris. Draft input was provided to ONWI for E-MAD nuclear waste package production for a proposed Test and Evaluation Facility. Process flow diagrams and supporting documentation were developed for eight alternate waste package configurations to be performed at a Generic Package Facility (GPF). A draft report, assessing requirements for a GPF, was completed and transmitted to DOE/NV and ONWI. AESD-Nevada Operations provided Quality Assurance support for the NNWSI drilling operations.E-MAD tours were conducted for approximately 1400 people. Two enclosures for E-MAD Stack Monitor detectors were constructed. Specifications and purchase requisitions were prepared for refurbishment of radiation shield windows to be installed in the E-MAD East Process Cell.

11876 **(DP—1640) SRL incinerator components test facility.** Freed, E.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Aug 1982. Contract AC09-76SR00001. 71p. NTIS, PC A04/MF A01. Order Number DE83003338.

A full-scale (5 kg waste/hour) controlled-air incinerator, the ICTF, is presently being tested with simulated waste as part of a program to develop technology for incineration of Savannah River Plant solid transuranic wastes. This unit is designed specifically to incinerate relatively small quantities of solid combustible waste that are contaminated up to 10^5 times the present nominal 10 nCi/g threshold value for such isotopes as ^{238}Pu, ^{239}Pu, ^{243}Cm, and ^{252}Cf. Automatic incinerator operation and control has been incorporated into the design, simulating the future plant design which minimizes operator radiation exposure. Over 3000 kg of nonradioactive wastes characteristic of plutonium finishing operations have been incinerated at throughputs exceeding 5 kg/hr. Safety and reliability were the major design objectives. In addition to the incinerator tests, technical data were gathered on two different off-gas systems: a wet system composed of three scrubbers in series, and a dry system employing sintered metal filters.

11877 **(DP—1645) Pilot solid-waste incinerator.** Farber, M.G.; Hootman, H.E.; Trapp, D.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 63p. NTIS, PC A04/MF A01. Order Number DE83004747.

An experimental program to develop and confirm technology for incinerating solid radioactive waste is in progress at the Savannah River Laboratory (SRL) in support of the short-term and long-term waste management objectives of the Savannah River Plant (SRP). This report reviews the experience of a pilot incinerator with a capacity of 1.0 lb/hr. The facility was tested with nonradioactive materials similar to the radioactive waste generated at the Savannah River site. The experimental program included determining operating parameters, testing wet and dry off-gas treatment systems, and evaluating materials of construction.

11878 **(DP-MS—82-8) Characterization of borosilicate glass containing Savannah River Plant radioactive waste.** Bibler, N.E.; Smith, P.K. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 15p. (CONF-820891—5). NTIS, PC A02/MF A01. Order Number DE83004931.

From 18. ceramic science conference on advances in materials characterization; Alfred, NY, USA (16 Aug 1982).

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Vitrification is the reference process for immobilization of radioactive waste from the Savannah River Plant. The waste, consisting mostly of hydrous oxides of Fe, Al, and Mn contaminated with fission products and alpha-emitting radionuclides, is mixed with glass-forming chemicals and melted at 1150°C to produce a durable borosilicate glass. In this paper, the results of studies characterizing glass containing actual radioactive waste are presented. The glass was produced in a small-scale joule heated melter in a shielded facility at the Savannah River Laboratory. Feed for the melter was a mixture of 35 wt % waste (primarily Fe_2O_3 and Al_2O_3) and 65 wt % frit (primarily SiO_2, Na_2O, and B_2O_3). The melt was poured into 600 cc stainless steel beakers and allowed to cool. The glass was intensely radioactive. Surface dose rates were approximately 10^6 rad/h. Specific activities (dpm/g glass) of the principle radionuclides were: 1.2×10^{10} for ^{137}Cs, 7.9×10^9 for ^{90}Sr, and 1.08×10^8 for alpha activity (primarily ^{238}Pu and ^{244}Cm). Examination by optical and electron microscopy indicated the presence of 1 to 5 wt % spinel crystals - primarily $NiFe_2O_4$. Leach tests indicated good durability in deionized water, brine, and silicate water. These latter two leachants simulate groundwater from possible geologic repositories. Release rates at 40°C based on gamma, beta, and alpha activity in a 28 day test were approximately 0.01 g glass/m_2-day. This result agrees with results of tests with glass containing simulated waste and indicates that the borosilicate glass effectively immobilizes SRP radioactive waste. During the leach tests, the pH of the leachates did not decrease even though they were exposed to the gamma, beta, and alpha radiation from this glass.

11879 **(DP-MS—82-40) Theoretical predictions for continuous-slurry feeding of a glass melter.** Routt, K.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 9p. (CONF-821107—42). NTIS, PC A02/MF A01. Order Number DE83004928.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

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Radioactive defense waste currently stored at the Savannah River Plant in liquid form is to be immobilized by incorporation into a borosilicate glass. The glass melter for this process will consist of a refractory-lined tank enclosed in a water-cooled, steel vessel and fed by an aqueous slurry of glass frit plus radioactive waste. As an aid to understanding the melting process and scaling data from small melters, conservation principles were used to develop equations for predicting the melt rate for a feedpile of arbitrary radius plus additional information regarding feedpile behavior and energy consumption.

11880 **(DP-MS—82-42) Efficient particulate scrubber for glass melter off-gas.** Wright, G.T. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 12p. (CONF-821107—44). NTIS, PC A02/MF A01. Order Number DE83002687.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

Operation of joule-heated, continuous slurry fed melters has demonstrated that off-gas aerosols are generated by entrainment of feed slurry and vaporization of volatile species from the melt. Effective off-gas stream decontamination for these aerosols can be obtained by utilizing a suitably designed and operated wet scrubber system. Results are presented for performance tests conducted with an air aspirating-type venturi scrubber processing a simulated melter off-gas aerosol. Mass removal efficiencies ranged from 99.5 to 99.8%. Details of the testing program and applications for melter off-gas system design are discussed.

11881 **(DPSP—79-1003(Del.)) Savannah River Plant waste-tank inspection manual.** McNatt, F.G. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). Jan 1979. Contract AC09-76SR00001. 84p. NTIS, PC A05/MF A01. Order Number DE83004821.

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This manual is provided as an aid in making visual and photographic inspections and steel thickness measurements of Building 241-F and -H underground waste storage tanks. It describes the inspection program, the storage tanks, the equipment and techniques used and the results of their application, and the inspection record-keeping methods.

11882 **(EGG-M—22882) Waste classification system for low-level radioactive wastes.** Wickham, L.E.; Rope, S.K. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 7p. (CONF-821107—43). NTIS, PC A02/MF A01. Order Number DE83005276.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

Some low-level radioactive waste represents both a chemical and radiological hazard, and it is desirable that management practices take this into account. This paper describes a waste classification system that could provide guidance on how mixed wastes could be separated for disposal, and the degree of disposal isolation each waste material or shipment needs. An example of this system's use is provided.

11883 **(EGG-TIO-M—02082) Research and disposition of highly loaded organic resins.** Schmitt, R.C.; Sumpter, K.C.; Reno, H.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 18p. (CONF-821103—62). NTIS, PC A02/MF A01. Order Number DE83005274.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Among the radioactive wastes produced during the cleanup of Unit 2 of the Three Mile Island (TMI) Nuclear Power Station were 50 highly-loaded EPICOR-II liners, used to remove activation products from contaminated water. The EPICOR-II liners are being sent to the Idaho National Engineering Laboratory where they are being placed in interim storage facilities and researched as special wastes. Development and evaluation of a special High-Integrity Container is also ongoing. The High-Integrity containers will make it possible to dispose of EPICOR-II liners at a commercial low-level waste facility. The research efforts include examining EPICOR-II liners to determine their integrity, solidifying EPICOR-II resins in cement and synthetic polymer, testing solidified EPICOR-II resins for compressibility and leachability, determining the degradation of EPICOR-II resins, and investigating the behavior of solidified EPICOR-II resin samples in soil environments.

11884 (EUR—7441, pp 1-22) **Pt. 1: Dissolution of plutonium oxide during the process.** Stojanik, B.; Wieczorek, H. 1981. (In German). Dep. NTIS (US Sales Only).

In Wet combustion of plutonium-containing wastes.

In wet combustion conditions with a reaction time of 20 hours, Pu oxides, excepting one high temperature calcinated Pu oxide, are transformed 94-99% dry weight into a soluble sulfate. This has been shown up to a plutonium concentration of 8 g/l in suspension. The reaction rate depends on the size of the particles. The plutonium sulfate is enriched during the solid phase of the suspension. The Pu saturation concentration in concentrated H_2SO_4 includes a maximum 80 +- 30 (mg Pu/l). By leaching the solid residue of the suspension with four times its volume of 0.1 M H_2SO_4 in the first leaching stage and with a volume doubled each time in the second and third stages, complete leaching is achieved. The operation is carried each time for three hours at ambient temperature. The leaching volumes must be chosen each time so that no Pu saturated solution appears in any leaching. The Pu saturation concentration during the first leaching is a round 11 to 132 g Pu/l. The ensuing leachings serve mainly for the desorption of the Pu absorbed. The solution resulting from the three leaching solutions includes around 1 - 2 mol/l of free sulfuric acid and a total sulfate concentration of 1.5 - 2.5 mol/l. The main cations -apart from Pu- are Al, Fe and Zn.

11885 (EUR—7441, pp 23-58) **Pt. 2: Non-active laboratory for demonstrating the ILONA process. Construction and operating results.** Damerau, G.; Kemmler, G.; Muhr, G.; Wieczorek, H. 1981. (In German). Dep. NTIS (US Sales Only).

In Wet combustion of plutonium-containing wastes.

The construction, operating results and Research and Development results achieved with or during the operation of the installation are described. The ILONA installation was designed in 1978 and from June to December 1979 was under trial operation. It is made up of the following principal components: reprocessing furnace, purifying of gas effluents and a liquid waste collector. Apart from simulated waste containing plutonium constituted of over 50% PVC, other wastes are also reprocessed in this installation. - The experimental installations set up proved to be valid. - The construction materials, glass, enamel and PTFE, showed no visible changes after six months operation at 250°C. - The separation yield of the gas purification plant is at its highest when the level of 7 moles/l of acid in column 1 is not exceeded in total and when the addition of oxidation air is around 2 cu.m/h. - In the active reagent in circulation only 17 or 5% of the residue or tantalum oxide employed for the plutonium oxide simulation remains in suspension, whilst the remainder settles on the reaction vessel and at the bottom of the acid tank.

11886 (EUR—7441, pp 59-68) **Pt. 3. Acid separation.** Damerau, G.; Kemmler, G.; Wieczorek, H. 1981. (In German). Dep. NTIS (US Sales Only).

In Wet combustion of plutonium-containing wastes.

H_2SO_4, HNO_3 and HCl acids appearing during wet combustion are separated out in a two-stage distillation plant. In stage 1 (flow rate up to 4.5 kg/h) virtually all the sulphuric acid can be be separated from the nitric and hydrochloric acids. It is obtained as a tail product with a concentration of 80 to 85% by weight and it can be recycled again. The nitric and hydrochloric acid mixture is withdrawn as head product and separated out in stage 2 (rate 3.2 kg/l). Around 85% of the nitrous gases can be recovered as nitric acid (60 - 65% by weight). The balance is obtained as an equimolar mixture with the hydrochloric acid as head product.

11887 (EUR—7441) Wet combustion of plutonium-containing wastes. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). 1981. 73p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83780178.

Selected papers were processed for inclusion in the energy data base.

11888 (Juel-Conf—42-Vol.2) Proceedings of the international seminar on chemistry and process engineering for high-level liquid waste solidification. Odoj, R.; Merz, E. (eds.). (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Chemische Technologie; Gesellschaft Deutscher Chemiker, Frankfurt am Main (Germany, F.R.). Fachgruppe Nuklearchemie). Jun 1981. 480p. (In German and English). (CONF-810650—Vol.1). NTIS (US Sales Only), PC A21/MF A01. Order Number DE82905800.

From International seminar on chemistry and process engineering for high-level waste solidification; Julich, F.R. Germany (1 Jun 1981).

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Volume II contains 23 of the 51 papers which were presented at the International Seminar on Chemistry and Process Engineering for High-Level Liquid Waste Solidification. The seminar consisted of four topics, solidification, process and product chemistry, waste product forms, and waste containment requirements. Seventeen papers have been abstracted and indexed and the remaining 6 have been title listed. (ATT)

11889 (KFK—3301) Results of research and development works 1981 of the Institute for Nuclear Waste Management Techniques. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik). Feb 1982. 39p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750929.

The emphasis of the work is on the development and characterization of waste products suitable for final storage, such as actinides and fission products from MAW/LAW, as well as on the development of methods for the treatment and solidification of radioactive wastes, e.g. wet chemical oxidation, vitrification and cementation. Investigations on the HAW-storage in salt are carried out in cooperation with the GSF.

11890 (MLM—3028) Pelletized waste form demonstration program, April-September 1982. Lewis, E.L.; Herbert, R.F. Jr. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 12 Jan 1983. Contract AC04-76DP00053. 53p. NTIS, PC A04/MF A01. Order Number DE83003803.

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Gas generation (radiolysis) testing of uncalcined soil pellets was performed. It was found that no gas was generated by nonradioactive pellets, but pellets containing ~ 0.5 wt % plutonium-238 produced four species of gases (CO, CO_2, H_2, and CH_4). Calculations showed that soil must contain > 330 μCi ^{238}Pu/g soil to exceed the WIPP gas generation acceptance value of 0.1 mole/ft^{3}y. Leachability testing of calcined soil/cement pellets spiked with plutonium-238 oxide was performed at ambient temperature in deionized water. The fractional leach rates of the 50 wt % calcined soil/50 wt % cement pellets were found to be approximately the same as those found previously for 50 wt % calcined sludge/50 wt % cement pellets (1×10^{-9} g/cm^2/day after 14-1/2 days of leaching). The leachability testing of simulated ash/CsCl/adsorbent/cement pellets was performed and Zeolon was found to be the best adsorbent for cesium. The percentages of cesium leached from pellets after 21 days were 86.2 wt % for pellets containing no adsorbent and 3.73 wt % for pellets containing 2.5 wt % Zeolon. The demonstration of the production waste pelletization line (PWPL) was completed, and three types of calcined waste (soil, ash, and sludge) were successfully pelletized. The calcination retort required replacement as a result of excessive corrosion at 850°C over a 2-y period. The pelletization press operated at 95% efficiency, and no mechanical problems occurred. The University of Dayton studied and evaluated the factors affecting the strength of immobilized waste pelletization products. It was confirmed that the main reason for the great difference in the compressive strength of cast and pressed pellets was the great difference in porosity. The report is included in the Appendix.

11891 (NUREG/CR—3066) Parameters and variables appearing in repository-siting models. Mercer, J.W.; Thomas, S.D.; Ross, B. (GeoTrans, Inc., Reston, VA (USA)). Dec 1982. 258p. NTIS, PC A12/MF A01 - GPO $8.00. Order Number DE83900701.

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Included in this report is a summary of data characterizing the parameters and variables appearing in repository siting models. These data cover the processes of saturates flow, unsaturated flow, surface water flow, geochemistry, heat transport, solute transport, and geomechanical response. Definitions and ranges of values are provided for equation parameters, source terms, dependent variables, boundary conditions, and initial conditions for the equations that are solved in the repository siting models. The data were compiled to help guide the selection of values of parameters and variables to be used in benchmark problems.

11892 (ONWI—2-Suppl.3) ONWI library reports list. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). Sep 1982. Contract AC06-76RL01830. 108p. NTIS, PC A06/MF A01. Order Number DE82022248.

This document is the fourth in a series listing reports on nuclear waste isolation received by the Library of the Office of Nuclear Waste Isolation (ONWI).

11893 (ONWI—9(81-4)) Technical progress report for the quarter, 1 July-30 September 1981. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1981. Contract AC06-76RL01830. 244p. NTIS, PC A11/MF A01. Order Number DE83005479.

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This report describes the technical accomplishments during the period from July through September 1981 on the commercial nuclear waste management programs under the direction of the Office of Nuclear Waste Isolation (ONWI). This office has lead responsibilities in the National Waste Terminal Storage program structure for oversight and for development of the general technology, and for geologic exploration of non-DOE land. A project management group, ONWI directs and evaluates studies, research, and development performed by subcontractors on repository sites and designs. The scope of ONWI activities includes providing the technology and facilities for the terminal isolation of these wastes by disposal in mined repositories deep underground in stable geologic formations. The ONWI program is organized into eight tasks: Systems; Waste Package; Site; Repository; Regulatory and Institutional; Test Facilities and Excavations; Land Acquisition; and Program Management. The accomplishments in each of these tasks are reported.

11894 (ONWI—9(82-1)) Technical progress report for the quarter, 1 October-31 December, 1981. (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1981. Contract AC06-76RL01830. 179p. NTIS, PC A09/MF A01. Order Number DE83005478.

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This report describes the technical accomplishments during the period from October through December 1981 on the commercial nuclear waste management programs under the direction of the Office of Nuclear Waste Isolation (ONWI). This office has lead responsibilities in the National Waste Terminal Storage program structure for oversight and for development of the general technology, and for geologic exploration of non-DOE land. A project management group, ONWI directs and evaluates studies, research, and development performed by subcontractors on repository sites and designs. The scope of ONWI activities includes providing the technology and facilities for the terminal isolation of these wastes by disposal in mined repositories deep underground in stable geologic formations. The ONWI program is organized into eight tasks: Systems; Waste Package; Site; Repository; Regulatory and Institutional; Test Facilities and Excavations; Land Acquisition; and Program Management. The accomplishments in each of these tasks are reported.

11895 **(ONWI—251) Annotated bibliography for the design of waste packages for geologic disposal of spent fuel and high-level waste.** Wurm, K.J.; Miller, N.E. (Battelle Columbus Labs., OH (USA)). Nov 1982. Contract AC06-76RL01830. 365p. NTIS, PC A16/MF A01. Order Number DE83004362.

This bibliography identifies documents that are pertinent to the design of waste packages for geologic disposal of nuclear waste. The bibliography is divided into fourteen subject categories so that anyone wishing to review the subject of leaching, for example, can turn to the leaching section and review the abstracts of reports which are concerned primarily with leaching. Abstracts are also cross referenced according to secondary subject matter so that one can get a complete list of abstracts for any of the fourteen subject categories. All documents which by their title alone appear to deal with the design of waste packages for the geologic disposal of spent fuel or high-level waste were obtained and reviewed. Only those documents which truly appear to be of interest to a waste package designer were abstracted. The documents not abstracted are listed in a separate section. There was no beginning date for consideration of a document for review. About 1100 documents were reviewed and about 450 documents were abstracted.

11896 **(ONWI—334-Vol.2-App.) Guidebook for reliability, availability, and maintainability analysis of NWTS repository equipment. Volume II. Appendices.** Orvis, D.D.; Frank, M.V.; Jacobsen, F.K.; Clarke, W.M. (General Atomic Co., San Diego, CA (USA)). Apr 1981. Contract AC06-76RL01830. 243p. NTIS, PC A11/MF A01. Order Number DE83005213.

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The purpose of this Guidebook is to provide the background and methodology for developing and incorporating reliability, availability, and maintainability (RAM) requirements into the National Waste Terminal Storage program. The need for operational RAM requirements stems from two main considerations: (1) to assure the effectiveness of a repository over its lifetime, and (2) to reduce the likelihood and amount of radiation exposure to the repository operating and maintenance staff. The contents of the Guidebook are presented in two volumes. Volume 1 consists of seven chapters that are arranged so that the programmatic and general RAM aspects are presented first (Chapters 1, 2 and 3). These are followed by qualitative methodology (Chapters 4 and 5). An introduction to quantitative methods is presented in the last two chapters (Chapters 6 and 7). In addition, Chapter 3 presents a description of a reference repository and general RAM concerns in order to provide perspective for the examples in the Guidebook. Volume 2 expands the methods discussed in Volume 1 but concentrates on the quantitative methods (Appendices A-C) including the use of recommended computer programs (Appendix D). Appendix E provides copies of blank worksheets for applying the methodology that can be reproduced by the user. Finally, Appendix F presents a Glossary of terms used in the Guidebook.

11897 **(ONWI—400) In situ and laboratory geotechnical test results from borehole GD-1 in southeast Utah.** Nelson, R.A.; Kocherhaus, J.G.; Schnapp, M.R. (Woodward-Clyde Consultants, San Francisco, CA (USA)). Nov 1982. Contract AC06-76RL01830. 202p. NTIS, PC A10/MF A01. Order Number DE83004904.

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In-situ testing was conducted in the Gibson Dome No. 1 (GD-1) borehole in southeastern Utah at depths ranging from 954 to 1507 m (3130 to 4945 ft). These tests were made in a number of salt strata to measure: (1) stress-strain behavior of the borehole (hole squeeze); (2) short-term borehole creep; and (3) in situ stresses in salt strata. Laboratory triaxial strength and creep tests were conducted on core removed from GD-1 to provide engineering data under a variety of test conditions (stress state, strain rate, and temperature. Results of in situ and laboratory tests will be used to assist in estimating the maximum feasible depth for a repository in the Gibson Dome Area. Stress-strain data reflected test zone behavior devoid of previous non-geologic stress influences. Radial strain creep rates were generally consistent with other laboratory tests and other direct measurements of borehole creep. Hydraulic fracture data indicated a non-lithostatic stress state at depths shallower than 1220 m (4000 ft). Laboratory triaxial strength tests and Young's modulus results displayed trends similar to those from salt in other locations, showing that Paradox salt has higher strengths than many other salts in similar test conditions.

11898 **(ORNL—5703) Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes.** Lomenick, T.F.; Gonzales, S.; Johnson, K.S.; Byerly, D. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 166p. NTIS, PC A08/MF A01. Order Number DE83005178.

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The thick and regionally extensive sequence of shales and associated clastic sedimentary rocks of Late Devonian and Early Mississippian age has been considered among the nonsalt geologies for deep subsurface containment of high-level radioactive wastes. This report examines some of the regional and basin-specific characteristics of the black and associated nonblack shales of this sequence within the Appalachian, Illinois, and Michigan basins of the north-central and eastern United States. Principal areas where the thickness and depth of this shale sequence are sufficient to warrant further evaluation are identified, but no attempt is made to identify specific storage/disposal sites. Also identified are other areas with less promise for further study because of known potential conflicts such as geologic-hydrologic factors, competing subsurface priorities involving mineral resources and groundwater, or other parameters. Data have been compiled for each basin in an effort to indicate thickness, distribution, and depth relationships for the entire shale sequence as well as individual shale units in the sequence. Included as parts of this geologic assessment are isopach, depth information, structure contour, tectonic elements, and energy-resource maps covering the three basins. Summary evaluations are given for each basin as well as an overall general evaluation of the waste storage/disposal potential of the Devonian-Mississippian shale sequence,including recommendations for future studies to more fully characterize the shale sequence for that purpose. Based on data compiled in this cursory investigation, certain rock units have reasonable promise for radioactive waste storage/disposal and do warrant additional study.

11899 **(PNL—4250-2) Nuclear-waste management semiannual progress report, April 1982-September 1982.** Chikalla, T.D.; Powell, J.A. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 134p. NTIS, PC A07/MF A01. Order Number DE83005125.

This document is one of a series of technical progress reports designed to report on radioactive waste management programs at Pacific Northwest Laboratory. Accomplishments in the following programs are reported: waste treatment; nuclear waste Materials Characterization Center (MCC); airborne waste management; low-level waste management; waste isolation; remedial actions; and supporting studies.

11900 **(PNL—4490) Recycle of iodine-loaded silver mordenite by hydrogen reduction.** Burger, L.L.; Scheele, R.D. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 55p. NTIS, PC A09/MF A01. Order Number DE83005030.

In 1977 and 1978, workers at Idaho National Engineering Laboratory (INEL) developed and tested a process for the regeneration and reuse of silver mordenite, AgZ, used to trap iodine from the dissolver off-gas stream of a nuclear fuel reprocessing plant. We were requested by the Airborne Waste Management Program Office of the Department of Energy to perform a confirmatory recycle study using repeated loadings at about 150°C with elemental iodine, each followed by a drying step at 300°C, then by iodine removal using elemental hydrogen at 500°C. The results of our study show that AgZ can be recycled. There was considerable difficulty in stripping the iodine at 500°C.; however, this step went reasonably well at 550°C or slightly higher, with no apparent loss in the iodine-loading capacity of the AgZ. Large releases of elemental iodine occurred during the drying stage and the early part of the stripping stage. Lead zeolite, which was employed in the original design to trap the HI produced, is ineffective in removal of

I_3. The process needs modification to handle the iodine. Severe corrosion of the stainless steel components of the system resulted from the HI-I_2-H_2O mixture. Monel or other halogen-resistant materials need to be examined for this application. Because of difficulty with the stripping stage and with corrosion, the experiments were terminated after 12 cycles. Thus, the maximum lifetime (cycles) of recycle AgZ has not been determined. Mechanistic studies of iodine retention by silver zeolites and of the behavior of silver atoms on the reduction stage would be of assistance in optimizing silver mordenite recycle.

11901 **(PNL-SA—10529) Potential role of biotic transport models in low-level-waste management.** Kennedy, W.E. Jr.; Soldat, J.K.; Cadwell, L.L.; McKenzie, D.H. (Pacific Northwest Lab., Richland, WA (USA)). 15 Jun 1982. Contract AC06-76RL01830. 7p. (CONF-821103—56). NTIS, PC A02/MF A01. Order Number DE83003456.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

This paper is a summary of the initial results of a study being conducted for the US Nuclear Regulatory Commission (NRC) to determine the relevance of biotic pathways to the regulation of nuclear waste disposal. Biotic transport is defined as the actions of plants and animals that result in the transport of radioactive materials from a LLW burial ground to a location where they can enter exposure pathways to man. A critical review of the role of modeling in evaluating biotic transport is given. Both current applications and the need for future modeling development are discussed.

11902 **(PNL-SA—10534) Handbook for the design, selection, and construction of a rock cover for retired uranium-mill tailings.** Parker, G.B. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1982. Contract AC06-76RL01830. 7p. (CONF-821209—3). NTIS, PC A02/MF A01. Order Number DE83005248.

From 5. annual symposium on uranium mill tailings management; Ft. Collins, CO, USA (9 Dec 1982).

As part of a Nuclear Regulatory Commission (NRC) study to assess the long-term protection of retired uranium mill tailings, the Pacific Northwest Laboratory (PNL) is developing a Handbook to guide the design, selection, and construction of a rock cover (riprap) for decommissioned and reclaimed uranium-mill tailings. The rock cover is designed for long-term protection of mill tailings from wind and water erosion. The purpose of the Handbook is twofold. First, it can be used as a manual by the uranium mill operators for designing, selecting, and constructing a rock cover. Second, the Handbook can be used as a guide to help the NRC evaluate the decommissioning and reclamation plans submitted to them by mill operators. Although the Handbook is not site-specific, it is structured to allow the design of a rock cover for any NRC-licensed tailings impoundment.

11903 **(PNL-SA—10620) Development of improved technology for decommissioning operations.** Allen, R.P. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. Contract AC06-76RL01830. 42p. (CONF-821005—20). NTIS, PC A03/MF A01. Order Number DE83002754.

From DOE international decommissioning symposium; Seattle, WA, USA (10 Oct 1982).

This paper describes the technology development activities conducted at Pacific Northwest Laboratory under US Department of Energy sponsorship to help ensure the availability of safe, cost-effective and environmentally sound decommissioning technology for radioactively contaminated facilities. These improved decommissioning technologies include techniques for the removal of contaminated concrete surfaces and coatings, adaptation of electropolishing and vibratory finishing decontamination techniques for field decommissioning applications, development of sensitive field instrumentation and methods for the monitoring of large surface areas, techniques for the field sectioning of contaminated components, improved contamination-stabilizing coatings and application methods, and development of a small solidification system for the field solidification of liquid waste. The results of cost/benefit studies for some of these technologies are also reported.

11904 **(PNL-SA—10649) Overview of the Monitored Retrievable Storage (MRS) program.** Rasmussen, D.E. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1982. Contract AC06-76RL01830. 7p. (CONF-820943—7). NTIS, PC A02/MF A01. Order Number DE83002738.

From ANS topical meeting - spent fuel storage; Savannah, GA, USA (26 Sep 1982).

The current objective of the DOE MRS/Interim Storage (IS) program is to ensure that the Government has the capability to accept and store high-level waste and spent fuel in the amounts and on a schedule determined by DOE goals for nuclear energy, legislation and regulation. Preliminary studies are complete and development of the concepts, with commercial sector involvement, is about to start. Spent fuel and high-level waste storage requirements for the reference case indicate minimum interim storage requirements if start of commercial reprocessing and repository availability remain on schedule.

11905 **(RHO-BW-CR—129P) Assessment of the effects of surficial geologic processes in the Pasco Basin.** (Woodward-Clyde Consultants, San Francisco, CA (USA)). Jul 1980. Contract AC06-77RL01030. 119p. NTIS, PC A06/MF A01. Order Number DE83005495.

Based on a review of available geologic data regarding surficial geologic processes that shaped the landscape in the Pasco Basin during Quaternary time, an estimate has been made of rates and the net effect of similar processes for the next million years. Landscape modification of the Pasco Basin during the past million years has been dominated by degradational processes. During catastrophic floods, rates of both aggradation and erosion were briefly accelerated. However, long-term rates of denudation and aggradation have been relatively low. These rates probably reflect dry climate and, perhaps more importantly, relatively low rates of uplift and subsidence. The net effect of surficial geologic process during the next million years probably will not be significantly different. Data on rates of surficial geologic processes, particularly rates of uplift and subsidence, are insufficient to accurately predict where the land surface will be in one million years. However, based on long-term rates of uplift, denudation, and channel incision, it is unlikely that more than 100 m of downcutting will occur anywhere within the Pasco Basin during the next million years. Rates of tectonic processes are the dominant factor affecting the evolution of the landscape in the Pasco Basin. More data are needed regarding distribution and ages of quaternary deposits to accurately assess tectonic rates during the past million years.

11906 **(RHO-BW-SA—269-P) Impact of seismicity on the stability of an underground repository.** Rasmussen, N.H.; Rohay, A.C. (Rockwell International Corp., Richland, WA (USA). Energy Systems Group). Dec 1982. Contract AC06-77RL01030. 14p. (CONF-821221—1). NTIS, PC A02/MF A01. Order Number DE83004676.

From American Geophysical Union conference; San Francisco, CA, USA (6 Dec 1982).

The effects of seismicity on an underground nuclear-waste repository are different from those normally associated with a surface nuclear facility. Vibratory damage to underground openings appears to result from peak ground velocities in excess of 25 to 100 cm/sec, depending on rock type and support structures. Although vibratory loading may be an important design consideration for the operational life of a repository ($\leqq$ 100 years), rupture of the host rock or shaft seals is the primary concern for the period of postclosure repository performance assessment ($\sim$ 10,000 years). The possible impact of seismic events on an underground repository is illustrated by means of a graph constructed using relationships between peak ground velocity, earthquake magnitude, and hypocentral distance. The possibility of a fault rupturing a repository is modeled using Brune's circular fault model and superimposed on the graph. The vibratory-damage thresholds are not exceeded unless the seismic event is sufficiently close that fault intersection of the repository is possible. Although these cases correspond to relatively large fault radii, the fault displacements are less than 1 cm and the average stress drops are of the order of one bar. At hypocentral distances approximately equal to the fault radii, the peak ground velocities imply peak shear stresses that are comparable to the stress drops of the earthquakes (1 to 100 bars), consistent with the Brune

model. Recurrence curves are considered in conjunction with the random probability of earthquake occurrence within specific hemispherical volumes in order to determine the annual probability of occurrence of various magnitude earthquakes within the volume. For b-values of 1.25, the possibility of exceeding the damage threshold is enarly independent of magnitude.

11907 **(SAND—82-0460) Seventh International NEA/ Seabed Working Group Meeting.** Anderson, D.R. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 201p. (CONF-8203107—). NTIS, PC A10/MF A01. Order Number DE83004765.

From 7. international NEA/Seabed working group meeting; La Jolla, CA, USA (15 Mar 1982).

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National policies and positions of Belgium, Canada, Commission of the European Communities, Federal Republic of Germany, France, Italy, Japan, the Netherlands, Switzerland, United Kingdom, and United States. The following task groups reported: System Analysis Task Group, Site Selection Task Group, Biology Task Group, Physical Oceanography Task Group, Sediment and Rock Task Group, Waste Form and Canister Task Group, and Engineering Studies Task Group.

11908 **(SAND—82-0664/1) Subseabed Disposal Program. Annual report, January-September 1981. Volume I: summary.** Hinga, K.R. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 55p. NTIS PCE06/MF $8.20. Order Number DE83005119.

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This is the eighth annual report describing the results of the investigations of the Subseabed Disposal Program. The program, international in scope, is evaluating the feasibility of disposing of high-level radioactive wastes by burial in certain geologically stable and economically valueless sediments of the deep sea floor.

11909 **(SAND—82-1439C) Formulation of an integrated physicochemical-hydrologic model for predicting waste-nuclide retardation in geologic media.** Muller, A.B.; Langmuir, D.; Duda, L.E. (Sandia National Labs., Albuquerque, NM (USA); Colorado School of Mines, Golden (USA)). 1982. Contract AC04-76DP00789. 18p. (CONF-821107—38). NTIS (US Sales Only). Order Number DE83005006.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

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The inability of empirical single value elements R/sub d/ values to model radionuclide retardation in nautral ground-water systems has demonstrated the need for developing a comprehensive integrated phenomenological model of the physicochemical and hydrologic mechanisms involved in retardation. The model must account for: (1) radioactive decay, (2) chemical precipitation/dissolution of bulk phases, (3) chemical substitution reactions, (4) isotopic exchange reactions, (5) cation and anion exchange, (6) specific adsorption, (7) diffusion into adjacent flow paths, (8) diffusion into fluid not involved in flow, (9) diffusion into the solid matrix and (10) ultrafiltration. The formulation of such a model is proposed, based on a reaction-path-simulation code with modifications for adsorption processes (by a surface-complexation site-binding model) and diffusion processes. The coupling of the physicochemical portion of this model to a ground-water transport code can be achieved by alternately iterating through the chemical and physical portions of the code during each time step. Sensitivity analysis used to determine dominant species, dominant retardation mechanisms and temporal and spatial homogeneities in the flow system will allow the integrated model to be reduced to a manageable form.

11910 **(SAND—82-2259C) Analysis of waste-package behavior for high-level waste.** Chu, M.S.; Campbell, J.E.; Stuckwisch, S.E.; Wahi, K.K.; Siegel, M.D. (Sandia National Labs., Albuquerque, NM (USA); INTERA Environmental Consultants, Lakewood, CO (USA); Auburn Univ., AL (USA); Science Applications, Inc., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 8p. (CONF-821107—40). NTIS, PC A02/MF A01. Order Number DE83005008.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

A sensitivity analysis was performed to determine the impact of the containment time criterion on compliance with the Environmental Protection Agency Draft Standard when using temperature-dependent leach rates. The results of this analysis indicate that canister design life can be shown to be important when the effects of temperature on leach rates are taken into account.

11911 **(SAND—82-2866C) Department of Energy ocean-disposal programs: complements to land-based disposal.** Anderson, D.R. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 11p. (CONF-821205—27). NTIS, PC A02/MF A01. Order Number DE83004011.

From NWTS information meeting on basalt waste isolation project; Las Vegas, NV, USA (14 Dec 1982).

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The geological formations beneath the oceans are in many ways different from those found on the continents. The characteristics of these formations, in some cases coupled with the ocean waters themselves, may provide environmentally suitable methods for disposal of certain types of radioactive wastes. This document outlines the most promising ocean disposal options. Any of these options may be chosen, for environmental, logistic, or economic reasons, to complement the US land-based disposal programs. Although much of the research is common to the determination of feasibility of all of these concepts, this document is divided for convenience into the categories of disposal within the oceanic geologic formations, disposal on the ocean floor, and disposal into the water column.

11912 **(SKBF-KBS-TR—81-13) Thermal stability of ion-exchange resins.** Aittola, J.-P.; Chyssler, J.; Ringberg, H. (SEE CODE- 6029620 Swedish Nuclear Fuel Supply Co., Stockholm; Kaernbraenslesaekerhet, Stockholm (Sweden)). 13 Jan 1982. 93p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE82703377.

The action of heat, radiation and oxidants on carbon chain polymers, such as ion-exchange resins, often cause irreversible chemical changes in macro molecules. These changes can be e g the rupture of the carbon-carbon single or double bond, and/or the degradation of the macro molecule. Ion-exchange materials also contain the far less stable bonds between functional groups and the polymer matrix. For this reason the thermal stability of ion-exchange materials is mainly based on the behaviour of the functional groups, which are responsible for the ion-exchange. The solidification of the ion-exchange resin waste usually involves elevated tempera- tures. Bituminization is carried out at 130-160 degrees C. Cementation is carried out at room temperature. However, cementation can generate temperatures of up to 100-120 degrees C in the solidification product during the curing period. In this study the swelling/ shrinking properties of different ion-exchange materials have been studied in air and water as a function of the drying time and temperature. The air dried resins were used as the reference material. The effect of sodium sulphate as a possible additive to reduce swelling was studied, The experiments which were performed and re- sults observed are discussed in detail in the Appendices.

11913 **(UCRL—53338) Effects of boundary conditions on thermomechanical calculations: Spent fuel test - climax.** Butkovich, T.R. (Lawrence Livermore National Lab., CA (USA)). Oct 1982. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01. Order Number DE83005219.

The effects of varying certain boundary conditions on the results of finite-element calculations were studied in relation to the

Spent Fuel Test - Climax. The study employed a thermomechanical model with the ADINA structural analysis. Nodal temperature histories were generated with the compatible ADINAT heat flow codes. The boundary conditions studied included: (1) The effect of boundary loading on three progressively larger meshes. (2) Plane strain vs plane stress conditions. (3) The effect of isothermal boundaries on a small mesh and on a significantly larger mesh. The results showed that different mesh sizes had an insignificant effect on isothermal boundaries up to 5 y, while on the smallest and largest mesh, the maximum temperature difference in the mesh was <1°C. In the corresponding ADINA calculation, these different mesh sizes produce insignificant changes in the stress field and displacements in the region of interest near the heat sources and excavations. On the other hand, plane stress produces horizontal and vertical stress differences approx. 9% higher than does plane strain.

11914 **Waste management at LAMPF.** Grishma, D.L.; Lambert, J.E. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **41**: 630-631(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

11915 **Release kinetics and alteration of waste glass in crystalline rock systems.** Shade, J.W. (Pacific Northwest Lab., Richland, WA (USA)). *Chemical Geology;* **36**: No. 1-2, 103-121(Jun 1982).

From Symposium on geochemistry of radioactive waste disposal, as part of the Geological and Mineralogical Associations of Canada, Annual General Meeting; Calgary, Alberta, Canada (May 1981).

See also AECL-7466; AECL-7460; AECL-7391.

Miniature open-end stainless steel canisters of uranium-doped PNL-76-68 waste glass were reacted with crushed basalt and granite at 250°C, 13.6 MPa, for up to 8 weeks. Solutions sampled periodically at P and T indicate that B and Mo release from glass is not affected by surrounding rock, but Cs release is lowered. Solution concentrations of alkali ions and silica in rock-dominated systems can be partly described by feldspar-quartz-water reactions. The altered glass surface is characterized by heavy-element zonation with an Fe-silicate fringe on the exposed surface.

11916 **Solubility equilibria in basalt aquifers: the Columbia Plateau, Eastern Washington, USA.** Deutsch, W.J.; Jenne, E.A.; Krupka, K.M. (Pacific Northwest Lab., Richland, WA (USA)). *Chemical Geology;* **36**: No. 1-2, 15-34(Jun 1982).

From Symposium on geochemistry of radioactive waste disposal, as part of the Geological and Mineralogical Associations of Canada, Annual General Meeting; Calgary, Alberta, Canada (May 1981).

A speciation-solubility geochemical model, WATEQ2, was used to analyse geographically-diverse groundwater samples from the aquifers of the Columbia Plateau basalts in eastern Washington. The groundwater samples compute to be at equilibrium with calcite which provides both a solubility control for dissolved Ca and a pH buffer. The modeling results indicate that metastable amorphic solids limit the concentration of dissolved Si and suggest the same possibility for Al and Fe. The results also suggest that the processes of dissolution of basaltic glass and formation of metastable secondary minerals are continuing even though the basalts are of Miocene age and presumably have undergone a long history of contact with groundwaters. The computed solubility relations are found to agree with the known assemblages of alteration minerals in the basalt fractures and vesicles, if account is taken of both the difficulty of identifying amorphic phases and the slow rate of formation of clay minerals at low temperatures. Because the chemical reactivity of the bedrock will influence the transport of solutes in groundwater, the observed solubility equilibria are important factors with regard to chemical-retention processes associated with the possible migration of nuclear waste stored in the earth's crust. Specifically, the occurrence of secondary minerals will enhance the sorption of dissolved radionuclides.

11917 **Influence of convective-energy transfer on calculated temperature distributions in proposed hard-rock nuclear waste repositories.** Eaton, R.R.; Reda, D.C. (Sandia National Labs., Albuquerque, NM (USA)). *Radioactive Waste Management (Oak Ridge, Tennessee);* **2**: No. 4, 343-361(Jun 1982).

This study assesses the relative influence of convective-energy transfer on predicted temperature distributions for a nuclear-waste repository located in water-saturated rock. Using results for energy transfer by conduction only (no water motion) as a basis of comparison, it is shown that a considerable amount of energy can be removed from the repository by pumping out water that migrates into the drift from regions adjacent to the buried waste canisters. Furthermore, the results show that the influence of convective-energy transfer on mine drift cooling requirements can be significant for cases where the in-situ permeability of the rock is greater than one millidarcy (a regime potentially encountered in repository scenarios).

11918 **Hydrogeology of radioactive waste isolation: the challenge of a rational assessment.** Davis, S.N. (Univ. of Arizona, Tucson). *Geological Society of America, Special Paper;* No. 189, 389-396(1982). (CONF-790284—).

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

Plans to isolate radioactive waste raise more questions than can be answered within the lifetime of today's researchers. The existence of a multitude of unanswered questions, however, is not a unique phenomenon related to waste isolation, but is a general characteristic of all science. Although most questions related to the isolation of radioactive waste are interesting scientifically, answers to only a small but critical fraction of the questions are vital to the practical aspects of the problem. Almost all hydrogeologic evaluations of repository sites convey an excessively negative view with respect to geologic processes. Repositories do not necessarily become more hazardous with time. Many slow, normal geologic processes will seal and cover repository sites, making radionuclide migration less likely in the future than at present. Furthermore, several more rapid geologic processes, which are viewed with great apprehension, will not always have negative effects. Faulting could block ground-water circulation near the repository and consequently slow the outward migration of radionuclides; volcanism could cover repository sites, with only a slight chance of a volcanic vent contracting the radioactive waste; and in most of the northern part of the Midwest, future glacial activity would probably plaster the ground surface with layers of till, thus helping to isolate and protect any potential deep repository. Safety of waste repositories will depend on multiple barriers to migration of radionuclides. Further research focused on each barrier, however, is required before repository safety is assured.

11919 **Removal of solubilized solvent extractants from aqueous waste streams.** Navratil, J.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). *Journal of Nuclear Science and Technology (Tokyo);* **18**: No. 7, 561-562(Jul 1981).

Published in summary form only.

11920 **Remedial actions at inactive uranium mill tailings sites.** Matthews, M.L. (Dept. of Energy, Albuquerque, NM). pp 196-199 of Radiation hazards in mining: control, measurement, and medical aspects. Gomez, M. (ed.). New York, NY; American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (1981).

From International conference on radiation hazards in mining: control, measurement, and medical aspects; Golden, CO, USA (4 Oct 1981).

In 1978, Congress enacted Public Law 95-604, the Uranium Mill Tailings Radiation Control Act of 1978. The Act authorizes the Department of Energy to stabilize and control the tailings from designated inactive uranium mill tailings sites in a safe and environmentally acceptable manner. DOE has established the Uranium Mill Tailings Remedial Actions (UMTRA) Project Office to implement, in cooperation with the affected States, Indian tribes and owners of the sites, remedial actions at the sites. The UMTRA Project Office

has initiated efforts to perform remedial actions in accordance with EPA cleanup standards.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 11866, 11867, 11893, 11894, 11901, 11909, 11915, 13066, 13067, 13100

11921 (DOE/EA—0106) Environmental assessment of the Oak Ridge Gaseous Diffusion Plant site. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Dec 1979. 205p. NTIS, PC A10/MF A01. Order Number DE83005845.

The history of the Oak Ridge Gaseous Diffusion Plant (ORGDP) is briefly presented. Plant operation and facilities are described. Alteratives for plant operation are explored including shutdown, alternative technology, relocation, and alternative subsystems. The affected environment is characterized according to regional demography, land use, geology, hydrology, meteorology, ecology, regional landmarks, and community characteristics. Consequences to the human environment, ecological environment, and physical environment are analyzed. A critical evaluation of impacts found no threat to human life, no significant intrusion of toxic materials into the human food chain, and no evidence of major harm to local wild animals, birds, plants, or aquatic life. The socio-economic benefits include (1) the amounts of power made available to serve the nation, (2) a reduction in the US balance-of-trade deficit through income from separative work sales to foreign governments, (3) potential reduction of crude oil imports, (4) environmental benefits from the decreased use of coal for power generation, and (5) benefits to the local economic system because of plant payroll and purchases.

11922 (DOE/UMT—0212) Multidimensional simulation of radon diffusion through earthen covers. Mayer, D.W.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1983. Contract AC06-76RL01830. 34p. (PNL—4458). NTIS, PC A03/MF A01. Order Number DE83005253.

The purpose of this report is to document applications of the RADMD model used at PNL to perform analyses of radon diffusion through uranium mill tailings cover systems. The accuracy of the numerical formulation of the RADMD model was demonstrated through a comparison with a two-dimensional analytic solution to the radon diffusion equation. Excellent agreement was obtained between two-dimensional radon concentration profiles predicted by RADMD and those obtained with the analytic solution. A simulation was made of radon diffusion into a test canister using the two dimensional capabilities of RADMD. The radon flux profile was computed and illustrates the effects of the canister on the surface radon flux. The influence of the canister on the radon flux was shown to be significant under certain circumstances. Defects in earthen cover systems were evaluated using the three dimensional capabilities of RADMD. The results support the expectation that defective covers can increase the surface flux from a covered tailings pile. Compared to a cover with no defects, radon flux could be elevated by as much as a factor of three when 20% of the radon control layer area contained pockets of reduced moisture. The effects of temporal and spatial variations in moisture content have been modeled by coupling RADMD with a variable saturated flow model. Two dimensional simulations were made of the time dependence of radon flux from a tailings site before and after cover placement. The results demonstrated the expected flux reduction produced by a thick earthen cover. Time dependence of the radon flux after cover placement was attributed to slight changes in moisture content of the cover material with time. The particular cover studied had a compacted clay layer that effectively attenuated the radon.

11923 (LA—9329-MS) Elution of radionuclides through columns of crushed rock from the Nevada Test Site. Treher, E.N.; Raybold, N.A. (Los Alamos National Lab., NM (USA)). Oct 1982. Contract W-7405-ENG-36. 136p. NTIS, PC A07/MF A01. Order Number DE83003891.

Results from the elution of radionuclides through columns of crushed tuff, granite, and argillite are presented. Good agreement between column and batch measurements on washed samples is generally observed for all three rock types. This is encouraging, since the results of batch measurements are often of value to show relative sorption under a variety of conditions, and their relevance to the migration of radionuclides under flowing conditions has been questioned. Column elution behavior depended upon sample mineralogy. For example, ^{85}Sr gave fairly sharp, symmetric peaks on granite, argillite, and devitrified tuffs; however, on a vitrophyre, the peak was 10 to 100 times broader. For ^{137}Cs, the most unusual behavior was found on granites, where for columns run at ~ 20 m/year, most of the cesium was retained at the load point. For all the radionuclides studied, except /sup 95m/Tc, zeolite-containing tuffs had to be run at flow rates of 10^3 to 10^4 m/year to obtain elutions, while samples composed primarily of alkali feldspar and SiO_2 gave elutions of ^{85}Sr, ^{137}Cs, and ^{133}Ba at flow rates of 10 to 100 m/year. Knowledge of the mineralogic compositions of tuffs and their ability to retard the migration of radionuclides is important - not only to identify the optimum horizon for a nuclear waste repository in Yucca Mountain, but also to estimate how well the repository will perform.

11924 (NUREG/CR—2894) Consolidation theory and its applicability to the dewatering and covering of uranium-mill tailings. Gates, T.E. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 40p. (PNL—4402). NTIS, PC A03/MF A01 - GPO $4.75. Order Number DE83004152.

This report is a review and evaluation of soil consolidation theories applicable for evaluating settlement during dewatering and subsequent covering of uranium-mill tailings. Such theories may be used to predict both consolidation and water flow related effects in uranium-mill tailings during drainage, following sluicing into burial pits. A consolidation theory to be useful must consider the effect of time-dependent loads, nonhomogeneous soil mass, nonlinear variation of soil properties with the stress-state parameters, large strain, and saturated and unsaturated flow. Constitutive relations linking the stress-deformation-state variables with void ratio should be adopted for predicting both consolidation and fluid-flow interaction in unsaturated uranium-mill tailings.

11925 (ONWI—348) Importance of organic compounds in ground water as radionuclide-mobilizing agents. Means, J.L. (Battelle Columbus Labs., OH (USA)). Dec 1982. Contract AC06-76RL01830. 69p. NTIS, PC A04/MF A01. Order Number DE83005335.

This report summarizes FY 1981 progress on Tasks 2 and 3 of ONWI program E-516-01700, Radionuclide Mobilization by Organic Complexing Agents. The objective of Task 2: Radionuclide Partitioning Analyses is to investigate the effect of organic complexing agents on radionuclide adsorption from 25 to 200°C. Preliminary experiments studying adsorption of Co, Sr, Cs, and U by kaolinite, illite, and montmorillonite in the presence and absence of oxalic acid yielded two interesting results: (1) adsorption of Co, Sr, and U by all three clays was fairly constant from 25 to 100°C, and then increased from 150 to 200°C; (2) in numerous instances, adsorption in systems containing oxalic acid actually exceeded that in controls containing no oxalic acid. In Task 3, Humate Flocculation Experiments, the colloid characteristics of complexes of humic and fulvic acid with Na, Ca, Al, Fe(II), Fe(III), ^{233}U, ^{232}Th, ^{241}Am, ^{237}Np, and ^{239}Pu at pH 3.5 to 9.0 were investigated. All metals tested had some effect on humic acid (HA) and fulvic acid (FA) solubility, with Al, Fe, and the actinides having the greatest effect. In general HA was flocculated to a greater extent than FA, and flocculation was pH dependent, low pH promoting HA or FA precipitation. While the metals affected HA and FA solubility, the HA and FA in turn altered metal solubility relative to inorganic blanks. In cases where extensive flocculation of HA or FA was evident at low pH, Fe(II), Th, and Am also precipitated from solution at low pH. At near neutral pH HA and FA formed soluble complexes with Fe(II), Fe(III), U, Th, Am, and Pu, increasing their solubility in solution relative to inorganic blanks.

11926 **(ORNL/TM—8104) FECWASTE: user's manual of a Finite-Element Code for simulating WASTE transport through saturated-unsaturated porous media. Environmental Sciences Division Publication No. 1907.** Yeh, G.T.; Strand, R.H. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 302p. NTIS (US Sales Only). Order Number DE83004691.

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This report presents the user's manual of FECWASTE, a Finite-Element Code for simulating WASTE transport through saturated-unsaturated porous media. The code is designed for generic application. For each site-specific application, 12 control cards are required to specify the size of data arrays and 6 control cards are used to assign the control numbers in the main program. In addition, prior to the execution of FECWASTE, FECWATER must be executed to yield the groundwater flow variables including the pressure head, total head, moisture content, and Darcy's velocity components. Input data to the computer code includes the program control indices, properties of the porous media, parameters of waste-media interaction, the geometry in the form of elements and nodes, boundary and initial conditions, and waste characteristics. Principal output includes the spatial distribution of the concentration and material fluxes at any desired time. Fluxes through various types of boundaries, material accumulated in the matrix and solution, and material transformed through decay and chemical, physical, and biological degradation are also the output, if desired.

0540 Health And Safety

REFER ALSO TO CITATION(S) 11852, 11860, 11862, 11903, 11906, 11918, 11921, 12284, 12828, 12863, 13100, 13170, 13171, 13401

11927 **(LA-UR—82-3483) Accident analysis and DOE criteria.** Graf, J.M.; Elder, J.C. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 16p. (CONF-821215—2). NTIS, PC A02/MF A01. Order Number DE83004727.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

In analyzing the radiological consequences of major accidents at DOE facilities one finds that many facilities fall so far below the limits of DOE Order 6430 that compliance is easily demonstrated by simple analysis. For those cases where the amount of radioactive material and the dispersive energy available are enough for accident consequences to approach the limits, the models and assumptions used become critical. In some cases the models themselves are the difference between meeting the criteria or not meeting them. Further, in one case, we found that not only did the selection of models determine compliance but the selection of applicable criteria from different chapters of Order 6430 also made the difference. DOE has recognized the problem of different criteria in different chapters applying to one facility, and has proceeded to make changes for the sake of consistency. We have proposed to outline the specific steps needed in an accident analysis and suggest appropriate models, parameters, and assumptions. As a result we feed DOE siting and design criteria will be more fairly and consistently applied.

11928 **(NUREG/CR—2832) Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982.** Eidson, A.F. (Inhalation Toxicology Research Inst., Albuquerque, NM (USA); Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA)). Dec 1982. 53p. (LMF—97). NTIS, PC A04/MF A01 - GPO $4.75. Order Number DE83900893.

The problems addressed are the protection of uranium will workers from occupational exposure to uranium through routine bioassay programs and the assessment of accidental worker exposures. Comparisons of chemical properties and the biological behavior of refined uranium ore (yellowcake) are made to identify important properties that influence uranium distribution patterns among organs. These studies will facilitate calculations of organ doses for specific exposures and associated health risk estimates and will identify important bioassay procedures to improve evaluations of human exposures. Sampling of airborne yellowcake at four uranium mills showed that aerosols were heterogeneous, changed with time and contained ~ 50% of the airborne uranium in particles greater than 12 μm aerodynamic diameter. Results are related to specific packaging steps and to predictions of appreciable upper respiratory tract deposition rates for the aerosols, if inhaled by a worker without respiratory protection. Previously used in vitro dissolution techniques were evaluated and the uses of the results for interpreting urinary bioassay data are described. Preliminary results from an inhalation experiment using rats indicate that the clearance patterns of inhaled uranium from lung agreed quantitatively with results from in vitro dissolution and infrared analyses of the yellowcake used. Preliminary results from an experiment to simulate contamination of a wound by yellowcake showed that more of the implanted dose of a less soluble form of yellowcake was retained at the wound site than of a more soluble form at 32 days after implantation. The results did not quantitatively agree with in vitro dissolution results. A two-year study of yellowcake from two mills was initiated. Twenty Beagle dogs were exposed by nose-only inhalation to a more soluble form of yellowcake and 20 to a less soluble form.

11929 (NUREG/CR—2832, pp 3-14) **Use of air sampling data from uranium mills to estimate respiratory tract deposition rates for inhaled yellowcake.** Eidson, A.F. Dec 1982. NTIS, PC A04/MF A01 - GPO $4.75.

In Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982.

Uranium aerosols generated during normal yellowcake packaging operations were sampled at four uranium mills. Samplers located in the packaging area were operated before, during and after drums of dried yellowcake were filled and sealed. Mediar aerosol concentrations ranged from 0.04 μg U/1 to 0.34 μg U/1 during the routine packaging operations at the four mills. The aerosols were heterogeneous and included a broad range of particle sizes. Both the concentrations and particle size distributions varied with time. Aerosol characteristics could often be related to individual packaging steps. Sampling of yellowcake by hand from a filled open drum to measure the yellowcake moisture content need not pose a unique hazard to the operator. The combined results show that appreciable amounts of airborne uranium would be expected to deposit in the nasopharyngeal compartment of the respiratory tract if inhaled by a worker not wearing respiratory protection.

11930 (NUREG/CR—2832, pp 15-24) **Use of in vitro dissolution data when interpreting uranium bioassay data.** Eidson, A.F.; Griffith, W.C. Dec 1982. NTIS, PC A04/MF A01 - GPO $4.75.

In Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982.

The high variability of yellowcake produced by different mills complicates the interpretation of routine bioassay data. A simple in vitro dissolution test is described for yellowcake to improve this interpretation. A series of experiments was designed to evaluate the relative importance of solvent composition, method, pH and temperature factors for yellowcake dissolution according to a model developed from the known composition of a test yellowcake and data from inhalation exposures of humans to UO_3 or U_3O_8. Useful in vitro dissolution results can be obtained using simulated serum ultrafiltrate or simulated lung fluid as the solvent. In vitro dissolution experiments estimated the soluble portion of the test yellowcake within a 95% confidence interval of +- 6% and showed that the dissolution rates of the more soluble and less soluble portions corresponded to Class D and Class Y compounds, respectively. It was not necesary to maintain physiological pH or temperature conditions to approximate the human model. A hypothetical inhalation exposure of a worker to the test yellowcake was considered and uranium body burden estimates were made assuming a urinary excretion rate of 1 μg uranium/1 of urine within 100 days after the exposure. The greatest utility of in vitro dissolution results was in the estimation of the more soluble fraction of the yellowcake and to indicate whether prior excretion of a Class D uranium compound and possible kidney damage could have occurred before detection of an exposure.

11931 **Occupational risk from nuclear power.** Hoy, H.C.; O'Donnell, F. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* 41: 46(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

0550 Regulations

REFER ALSO TO CITATION(S) 13334

11932 **(DOE/EIA/10683—T1) Enrichment, demand, planning, facility deployment, and pricing.** Andress, D.A. (Scientific Systems, Inc., Cambridge, MA (USA)). Apr 1981. Contract AC01-80EI10683. 100p. NTIS, PC A05/MF A01. Order Number DE83003798.

Portions of document are illegible.

The International Nuclear Model is an iterative decision-based model, where decisions are based on market expectations. Methodology and algorithms for scheduling fuel-cycle facilities and for developing fuel-cycle unit costs are presented. The design of the automated algorithms for the Long Range Fuel Cycle Expectations, and Fuel Cycle Facility Deployment and Planning matrix elements in the Supply row and for the Long Range Price Expectations and Price Generation for new Contracts matrix elements in the Prices row is discussed. The input to these algorithms is the expected regional fuel-cycle requirements. Several algorithms, presented for fuel-cycle deployment and unit pricing, represent different degrees of complexity. Chapter 3 describes a simple algorithm for waste management facilities, both AFR storage and permanent disposal. Chapter 4 presents a separable linear program for fuel cycle deployment. This linear program optimally constructs fuel cycle facilities when their costs are given according to a scaling factor. Chapter 5 discusses the equations applicable to the enrichment process. Chapter 6 describes a linear program for enrichment planning which does explicitly consider feedstock levels. Chapter 7 describes several methodologies for calculating the unit price, with the rolling levelized-cost methodology spelled out in detail. (PSB)

11933 **(EGG-WM—5792-Rev.1) Technical plan for the development of an assay system for INEL-stored TRU waste.** Hinckley, J.P. (Idaho National Engineering Lab., Idaho Falls (USA)). Nov 1982. Contract AC07-76ID01570. 46p. NTIS, PC A03/MF A01. Order Number DE83003906.

The purposes of this technical plan are: to describe plans for the development, construction, and testing of a system for assaying INEL stored transuranic (TRU) waste for fissile inventory, estimating the thermal power density of the waste, and identifying waste containing less than 100 nCi/g (this assay information will be used for waste certification and for criticality control in the Processing Experimental Pilot Plant (PREPP)); and to identify the decisions to be made in developing the system, and the tasks that will generate the data necessary to make each decision. Two counters will be developed: a drum counter, to be delivered to the Stored Waste Examination Pilot Plant (SWEPP) at the end of FY 1984; and a box/bin counter to be delivered at the end of FY 1986. Both systems will use the differential dieaway technique (DDT), an active neutron interrogation technique. Los Alamos National Laboratory is responsible for design and construction of the assay system. EG & G is responsible for program direction and all SWEPP interfaces with the assay system.

11934 **(EUR—7580) International safeguards data management system.** Argentesi, F.; Costantini, L.; Franklin, M.; Casilli, T.; Dondi, M.G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703387.

The data base management system "ISADAM" (i.e. International Safeguards Data Management System) described in this report is intended to facilitate the safeguards authority in making efficient and effective use of accounting reports. ISADAM has been developed using the ADABAS data base management system and is implemented on the JRC-Ispra computer. The evaluation of safeguards declarations focuses on three main objectives: - the requirement of syntactical consistency with the legal conventions of data recording for safeguards accountancy; - the requirement of accounting evidence that there is no material unaccounted for (MUF); - the requirement of semantic consistency with the technological characteristics of the plant and the processing plans of the operator. Section 2 describes in more detail the facilities which ISADAM makes available to a safeguards inspector. Section 3 describes how the MUF variance computation is derived from models of measurement error propagation. Many features of the ISADAM system are automatically provided by ADABAS. The exceptions to this are the utility software designed to: - screen plant declarations before loading into the data base, - prepare variance summary files designed to support real-time computation of MUF and variance of MUF, - provide analyses in response to user requests in interactive or batch mode. Section 4 describes the structure and functions of this software which have been developed by JRC-Ispra.

11935 **(EUR—7580-EN) International safeguards data-management system.** Argentesi, F.; Casilli, T.; Costantini, L.; Dondi, M.G.; Franklin, M. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 103p. European Community Information Service, 2100 M Street, N.W., Suite 707, Washington, DC 20037.

This report describes a variety of features of a data base system (ISADAM) developed at JRC-Ispra for Euratom Safeguards Accountancy declarations from nuclear facilities throughout the European Community. The facilities which ISADAM makes available to a safeguards inspector are described. The derivation of the MUF variance computation from measurement error propagation models is described. Finally, the data processing structure of ISADAM is described. (DLC)

11936 **(GAO/ID—82-21) Obstacles to US ability to control and track weapons-grade uranium supplied abroad.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 2 Aug 1982. 99p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

The United States has exported over 16,000 kilograms of highly enriched uranium for use in research reactors in over 40 nations. GAO learned that the central computerized system used for tracking such exports is incomplete and inaccurate. Intended users also consider it inadequate and unreliable. In addition, three other systems gather information on highly enriched uranium. GAO recommends streamlining and consolidating the information maintained on this material in a more accurate, comprehensive, and flexible manner. GAO believes that reducing the use of highly enriched uranium is a sound non-proliferation objective. A number of obstacles, however, must be overcome if the conversion of research reactors to non-weapons grade fuels is to become a reality in the next few years. In the meantime, US ability to ensure adequate physical protection of highly enriched uranium supplied abroad is limited and international safeguards of nuclear material need further improvement.

11937 **(HEDL-SA—2765-FP) Safeguards through secure automated fabrication.** DeMerschman, A.W.; Carlson, R.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 19 Aug 1982. Contract AC06-76FF02170. 8p. (CONF-821119—11). NTIS, PC A02/MF A01. Order Number DE83004068.

From International symposium on recent advances in nuclear materials safeguards; Nienna, Australia (8 Nov 1982).

Westinghouse Hanford Company, a prime contractor for the U.S. Department of Energy, is constructing the Secure Automated Fabrication (SAF) line for fabrication of mixed oxide breeder fuel pins. Fuel processing by automation, which provides a separation of personnel from fuel handling, will provide a means whereby advanced safeguards concepts will be introduced. Remote operations and the inter-tie between the process computer and the safeguards computer are discussed.

11938 **(KFK—3309) Results of research and development work 1981 of the Development Department for Nuclear Materials Safeguards.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Entwicklungsgruppe Kernmaterialsicherung). Feb 1982. 7p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750941.

The work effected as part of the nuclear safeguards activities deal with a dynamic nuclear material balance for large reprocessing plants, a safeguarding concept of the separating nozzle plant for Brazil, and the co-ordination of the interlaboratory tests IDA-80. Investigations on a fence detection system and model considerations on the diffusion of clouds caused by explosion concern the safeguarding of nuclear materials and installations.

11939 **(LA—9544-M) Inventory-sample coincidence-counter manual.** Menlove, H.O.; Holbrooks, O.R.; Ramalho, A. (Los Alamos National Lab., NM (USA)). Nov 1982. Contract W-7405-ENG-36. 21p. NTIS, PC A02/MF A01. Order Number DE83003999.

A small passive neutron coincidence counter has been designed for plutonium assay in inventory samples. This portable system can be used in the product sampling area to measure powders, pellets, and liquids. The manual describes the system and gives performance and calibration parameters for typical applications.

11940 **(MLM—3009) Selected measurement data for plutonium and uranium.** Anderson, M.E.; Lemming, J.F. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). Nov 1982. Contract AC04-76DP00053. 81p. (ISPO—157). NTIS, PC A05/MF A01. Order Number DE83901008.

Portions of document are illegible. Printed copy available until stock is exhausted.

This handbook is designed primarily for use by inspectors when verifying the nuclear material contents of samples by nondestructive means. It contains discussions of various properties and the applicability of the measurement of these properties toward verification of specific samples. Because the thrust of this handbook is with properties rather than techniques or instruments, portions of it may be useful to other analysts as a reference.

11941 **(PNL-SA—10574) Loss detection and alarm resolution in processing special nuclear material.** Eggers, R.F. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 5p. (CONF-821103—53). NTIS, PC A02/MF A01. Order Number DE83003657.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Objective is to outline the major features of two prompt detection and alarm resolution systems designed under the proposed NRC material control and accounting (MC & A) Reform Amendment. Detailed studies were conducted to NRC to ascertain whether loss detection and alarm resolution systems meeting the requirements of this proposed amendment could be designed for current nuclear material processes. Some of the general results of this study are discussed for two of these processes: mixed oxide fuel fabrication and uranium hexafluoride conversion.

11942 **(UCRL—87250) Control of information as an element of nuclear safeguards.** Green, J.N. (Lawrence Livermore National Lab., CA (USA)). Mar 1982. Contract W-7405-ENG-48. 5p. (CONF-820713—29). NTIS, PC A02/MF A01. Order Number DE83004247.

From Institute of Nuclear Materials meeting; Washington, DC, USA (19 Jul 1982).

Control of information as an element of physical protection has a long history in the field of national security. The nuclear industry is familiar with the constraints on proprietary information; and, with an effective date of October 1, 1980 for Parts 25 and 95 in Title 10 of the code of Federal Regulations, certain activities had to cope with rules for safeguarding of classified information. In applying the rules it is important to understand the differences between national security information and restricted data, and how guidance is promulgated both by the Nuclear Regulatory Commission (NRC) and by the Department of Energy. More recently, with a fully effective date of January 20, 1982, the NRC published rules for the protection of unclassified safeguards information. The scope is much broader than for the classified information. For example, the rules are applicable to power reactors. In this paper the directives which provide the details for compliance with all these rules are identified, and their application is discussed. NRC inspectors will be checking for compliance with the rules. Once problems of compliance are resolved, the more difficult question of evaluating the impact of information control procedures on the effectiveness of a physical protection system can be addressed.

11943 **Demonstration of microscopic process monitoring for reprocessing plant safeguards.** Hurrell, S.J.; Wachter, J.W. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **41**: 141-142(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

06 FUSION FUELS

0602 Processing

11944 **(KMSF-U—1266) Recent laser fusion experiments at KMS.** Slater, D.C. (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1982. Contract AC08-82DP40152. 18p. (CONF-820930—9). NTIS, PC A02/MF A01. Order Number DE82020324.

From 9. international conference on plasma physics and controlled nulcear fusion research; Baltimore, MD, USA (1 Sep 1982).

As part of the US Inertial Confinement Fusion program, KMSF conducts laser-target experiments that address specific issues of importance to the entire short-wavelength program. Spherical target irradiation experiments with the all-reflective, triple-bounce illumination system at 1.05 μm and 0.53 μm explored compression physics with cryogenic targets, and transport of energy by thermal and suprathermal electrons. These fully-integrated campaigns include the design of the experiments using KMSF-developed plasma and hydrocodes, target fabrication and characterization, and subsequent theoretical modeling and interpretation of results.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

11945 **(INIS-mf—7225) Proceedings of the 1977 joint annual convention, Radioisotope Society of the Phillippines Inc., and the Philippine Society for Nuclear Medicine.** Nov 1977. 200p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE83780237.

From Joint annual convention of the Radioisotope Society of the Philippines Inc. and the Philippine Society for Nuclear Medicine on Radioisotope and the Common Man; Philippines (11 Nov 1977).

Papers presented were entered into the data base separately. (WHK)

0702 Radiation Sources

11946 **(CONF-8111132—1) Radioisotope-powered light sources.** Haff, K.W.; Case, F.N.; Tompkins, J.A.; Remini, W.C. (Oak Ridge National Lab., TN (USA); Department of Energy, Washington, DC (USA)). Nov 1981. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01. Order Number DE83003436.

From Illuminating Engineering Society aviation lighting seminar; Williamsburg, VA, USA (9 Nov 1981).

Significant progress has been made in the past year to improve the geometry of ^{85}Kr-powered lights, making it possible to acquire the lights from a greater distance than was previously possible. This paper is an update and current status report on the work being done and the improvements made in both ^{85}Kr and tritium lights since the report made by F.N. Case and W.C. Remini at the November 1980 IES meeting.

11947 **(DPST—82-854) Cesium glass irradiation sources.** Plodinec, M.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 14 Sep 1982. Contract AC09-76SR00001. 11p. NTIS, PC A02/MF A01. Order Number DE83005044.

The precipitation process for the decontamination of soluble SRP wastes produces a material whose radioactivity is dominated by ^{137}Cs. Potentially, this material could be vitrified to produce irradiation sources similar to the Hanford CsCl sources. In this report, process steps necessary for the production of cesium glass irradiation sources (CGS), and the nature of the sources produced, are examined. Three options are considered in detail: direct vitrification of precipitation process waste; direct vitrification of this waste after organic destruction; and vitrification of cesium separated from the precipitation process waste. Direct vitrification is compatible with DWPF equipment, but process rates may be limited by high levels of combustible materials in the off-gas. Organic destruction would allow more rapid processing. In both cases, the source produced has a dose rate of 2×10^4 rads/hr at the surface. Cesium separation produces a source with a dose rate of 4×10^5 at the surface, which is nearer that of the Hanford sources (2×10^6 rads/hr). Additional processing steps would be required, as well as R and D to demonstrate that DWPF equipment is compatible with this intensely radioactive material.

11948 **Metallograph for the examination of low-level radioactive samples.** Cook, J.H.; Petty, W.F.; Shaffer, D.S. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **41**: 639-640(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

0703 Isotopic Power Supplies

REFER ALSO TO CITATION(S) 12518

11940 **(DP-MS—82-49) Surface studies of iridium-alloy grain boundaries associated with weld cracking.** Mosley, W.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 43p. (CONF-8210112—1). NTIS, PC A03/MF A01. Order Number DE83004919.

From 11. conference on surface studies and 6. SUBWOG-12B technical exchange; Los Alamos, NM, USA (5 Oct 1982).

Portions of document are illegible.

Plutonium-238 oxide fuel pellets for the General Purpose Heat Source (GPHS) Radioisotopic Thermoelectric Generators to be used on the NASA Galileo Mission to Jupiter and the International Solar Polar Mission are produced and encapsulated in iridium alloy at the Savannah River Plant (SRP). Underbead cracks occasionally occur in the girth weld on the iridium-alloy-clad vent sets in the region where the gas tungsten arc is quenched. Grain-boundary structures and compositions were characterized by scanning electron microscopy/x-ray energy spectroscopy, electron microprobe analysis and scanning Auger microprobe analysis to determine the cause of weld quench area cracking. Results suggest that weld quench area cracking may be caused by gas porosity or liquation in the grain boundaries.

11950 **(DPST—82-128-2) ^{238}Pu fuel form processes. Quarterly report, April-June 1982.** j. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Nov 1982. Contract AC09-76SR00001. 58p. NTIS, PC A04/MF A01. Order Number DE83004624.

Progress in studies of ^{238}Pu fuel form processes is reported. Analytical studies of weld-quench cracking in DOP-26 iridium alloy-clad vent sets in General Purpose Heat Sources (GPHS) showed that weld-quench cracking is much more severe in MER alloy than in LR and NR alloys. Spark source mass spectrometry indicated that areas in DOP-26 alloy with severe weld-quench cracking have high thorium inhomogeneity. Secondary ion mass spectrometry revealed differences in LR and MR alloys that may be related to their dissimilar susceptibilities for weld-quench cracking. Impact ductility tests showed that welds in DOP-26 alloy clad vent sets made using parameters similar to PuFF production welding had high elongations. Decontamination of encapsulated GPHS pellets in PuFF was demonstrated using a solution of 3.5 M HNO_3 + 6.4 M HF which is capable of reducing transferable contamination below the specified 10^3 dpm upper limit in <30 minutes at a bath temperature of 80°C using ultrasonic cleaning. Decontamination vessels were constructed to trap and condense acid vapors during decontamination. Impact and metallographic data showed that although the micro and macrostructures between LANL and SRL pellets have large differences, the difference in impact response between these two types of pellets is not correspondingly large. Both types of pellets have impacted successfully. The micro and macrostructures of SRP pellets made with either low fired shards sintered in $Ar/5\%O_2$ or Ar are intermediate between those of the LANL and SRL pellets. Therefore, either type of SRP pellet should impact successfully.

11951 **(DPST—82-813) Strontium-90 and promethium-147 recovery.** Hoisington, J.E.; McDonell, W.R. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 30 Aug 1982. Contract AC09-76SR00001. 36p. NTIS, PC A03/MF A01. Order Number DE83005043.

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Strontium-90 and promethium-147 are fission product radionuclides with potential for use as heat source materials in high reliability, non-interruptible power supplies. Interest has recently been expressed in their utilization for Department of Defense (DOD) applications. This memorandum summarizes the current inventories, the annual production rates, and the possible recovery of Sr-90 and Pm-147 from nuclear materials production operations at Hanford and Savannah River. Recovery of these isotopes from LWR spend fuel utilizing the Barnwell Nuclear Fuels Plant (BNFP) is also considered. Unit recovery costs at each site are provided.

11952 **(DPST—82-839) Additional Pu-238 production.** O'Neill, G.F. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 4 Oct 1982. Contract AC09-76SR00001. 7p. NTIS, PC A02/MF A01. Order Number DE83005047.

Possible DOD demands for up to 1 MW thermal of heat sources could be partially met by increasing SRP Pu-238 production. The Pu-238 would be an alternate or supplement to Sr-90 in these heat sources. There is a growing surplus of Np-237 target material which could be used to produce high-assay Pu-238 (83.5%). In addition SRP produces low assay Pu-238 (~ 27%) that could be extracted instead of being sent to the waste tanks. About 216 kg or 121 kw thermal of additional high-assay Pu-238 could be produced at SRP through FY1997; it would produce power at an incremental cost of ~ $1160/watt. About 77 kg or 44 kw thermal of low assay Pu-238 could also be recovered through FY1997; it would generate power at ~ $1850/watt. These quantities would supply only a fraction (~ 1/6 of the 1 MW demand projection. Also the costs are considerably higher than the costs for Sr-90 fission product heat sources. Sr-90 from SRP and Hanford could supply the total 1 MW thermal requirement (150 MCi at $1 to $3 per Ci) at costs in the range of $150 to $450 per watt.

11953 **(DPST—82-842) Radioisotopes for heat-source applications.** Hoisington, J.E. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 6 Oct 1982. Contract AC09-76SR00001. 14p. NTIS, PC A02/MF A01. Order Number DE83005045.

Potential DOD requirements for noninterruptable power sources could total 1 MW thermal by FY 1990. Of the three isotopes considered, (^{90}Sr, ^{147}Pm, ^{238}Pu) ^{90}Sr is the only one available in sufficient amounts to meet this requirement. To meet the DOD FY 1990 requirements, it would be necessary to undertake ^{90}Sr recovery operations from spent fuel reprocessing at SRP, Hanford, and the Barnwell Nuclear Fuels Plant (BNFP). ^{90}Sr recovery from the existing alkaline high level waste (HLW) at Hanford and SRP is not attractive because the isotopic purity of the ^{90}Sr is below that required for DOD applications. Without reprocessing LWR spent fuel, SRP and Hanford could not supply the demand of 1 MW thermal until FY 1996. Between FY 1983 and FY 1996, SRP and Hanford could supply approximately 0.70 MW of ^{90}Sr and 0.15 MW of ^{147}Pm. SRP could supply an additional 0.15 MW from the

production and recovery of ^{238}Pu. Strontium-90 is the most economical of the three heat source radionuclides considered. The ^{90}Sr unit recovery cost from SRP fresh acid waste would be $180/watt. The BNFP ^{90}Sr recovery cost would be $130/watt to $235/watt depending on the age and burnup of the LWR spent fuel. Hanford ^{90}Sr recovery costs form Purex fresh acid waste are unavailable, but they are expected to be comparable to the SRP costs. ^{147}Pm and ^{238}Pu are considerably more expensive heat source materials. ^{147}Pm recovery costs at SRP are estimated to be $450/watt. As with ^{90}Sr, the Hanford ^{147}Pm recovery costs are expected to be comparabl to the SRP costs. Production of high assay (93.5%) ^{238}Pu at SRP from excess ^{237}Np would cost about $1160/watt, while recovery of low assay (27%) ^{238}Pu from the waste stream is estimated at $1850/watt.

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 12057, 12733

11954 **(BLG—549) Active electrodes to be used in advanced alkaline-water electrolysis.** Vandenborre, H.; Leysen, R.; Vermeiren, P. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium). Studiecentrum voor Kernenergie). Sep 1982. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900365.

Some active electrodes to be used in alkaline water electrolysis are discussed. As far as the cathode is concerned Pt, NiB, $NiCo_2S_4$, Ni_3S_2, FeS_2 and Fe have been investigated. An interesting electrocatalyst seems to be nickel sulfide. The role of iron in the electrocatalytic activity of the hydrogen evolution reaction is not clear at the moment. A beneficial influence has been noticed when Fe-ions were reduced under conditions of hydrogen evolution. As anode materials Ni, $NiCo_2O_4$ have been tested out. $NiCo_2O_4$ as well as Co_3O_4 show good results compared to Ni for the oxygen evolution reaction in alkaline medium.

11955 (SERI/CP—234-1590, pp 1-4) **State of the art: steam hydrocarbon reforming.** Boyd, P. (United Catalysts Inc., Louisville, KY). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

An assessment is given on the technology of steam hydrocarbon reforming by reviewing the types of feed, feed pretreatment, types of primary and secondary reformers, and the types of catalysts used in the past and the present. Plans for future modifications to gas reforming processes are briefly discussed.

11956 **(SERI/TP—235-1814) Engineering analysis of potential photosynthetic bacterial hydrogen-production systems.** Herlevich, A.; Karpuk, M.; Lindsey, H. (Solar Energy Research Inst., Golden, CO (USA)). Jan 1983. Contract AC02-77CH00178. 11p. (CONF-820993—1). NTIS, PC A02/MF A01. Order Number DE83005107.

From Biochemical engineering conference; Santa Barbara, CA, USA (20 Sep 1982).

Portions of document are illegible. Printed copy available until stock is exhausted.

An engineering anlaysis was performed at SERI to examine system requirements for application of the photosynthetic bacteria process to large-scale hydrogen production. A system capable of producing 28,000 m^3 of hydrogen per day was conceptually designed. Two cases were examined: the first with 3% conversion efficiency, the second with 10% efficienty. The higher efficiency represents the potential for hydrogen production as estimated by SERI microbologists. Research into the efficiency of the biological process and substrate pretreatment requirements must also continue. If these problems are attacked in parallel, a useful technology for hydrogen production from renewable sources will become available in the near term.

0802 Storage

REFER ALSO TO CITATION(S) 12697

11957 **(Juel—1737) Structure and phase transitions in the vanadium-hydrogen and vanadium-deuterium system.** Pesch, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung). Sep 1981. 75p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82750922.

Electron microscopy is shown to give valuable qualitative information for the study of hydride structures and phase transformations in metal-hydrogen systems: in many cases for very high magnifications only the methods of bright and dark field imaging and the asignment of single domain diffraction patterns allow an unambigious determination of the phase transformation. The following results have been obtained: the well established structures in the V-H and V-D system are confirmed; the phase transitions $\beta \longleftrightarrow \beta'$ in the V-H system and $\gamma \longleftrightarrow$ delta in the V-D system are continuous; at low temperatures a two-phase region β+delta exists in the V-H system; in the over stochiometric γ-phase region $V_4Dsub(3+x)$ small systematic superstructure reflex shifts are observed, which can be explained very well by a model of incommensurable deuterium density modulations.

0808 Properties

11958 (SAND—82-8882, pp 55-76) **Effect of surface chemistry on the development of the [OH] in a combustion boundary layer.** Cattolica, R.J. (Sandia National Labs., Livermore, CA); Schefer, R.W. Oct 1982. NTIS, PC A08/MF A01.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

The development of a combustion layer formed by flowing a lean hydrogen-air mixture (phi = 0.1) over a high temperature (117OK) flat plate has been investigated. Two different plate surface materials were studied: platinum and quartz. The OH concentration and temperature were measured respectively by laser induced fluorescence and Rayleigh scattering. The highly non-equilibrium OH concentration profiles were compared with the results of a numerical boundary layer model. The effect of surface chemistry was evaluated with three general surface chemistry boundary conditions: noncatalytic, surface oxidation, and surface oxidation with radical recombiation. Near the leading edge of the flat plate the [OH] gradient obtained from the measured profiles for the platinum and quartz surfaces indicated a net OH production. Farther downstream the [OH] profiles were substantially different, with the quartz surface behaving similar to the noncatalytic boundary condition and the platinum surface behaving similar to the boundary condition for surface oxidation with radical recombiantion. 9 figures.

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 11598, 11645, 11652, 11679, 12024, 12032, 12040, 12047, 12051, 12052, 12067, 12068, 12069, 12070, 12071, 12072, 12073, 12074, 12075, 12076, 12077, 12078, 12080, 12082, 12083, 12084, 12091, 12099, 12100, 12102, 12104, 12525, 12543, 12628, 12630, 12634, 12652, 12751, 13082

11959 **(ANL/CNSV-TM—103) Demonstration of landfill gas-enhancement techniques in landfill simulators.** Walsh, J.; Vogt, G.; DiPuccio; Kinman, R.; Rickabaugh, J. (SCS Engineers, Inc., Covington, KY (USA); Cincinnati Univ., OH (USA)). Sep 1982. Contract W-31-109-ENG-38. 106p. NTIS, PC A06/MF A01. Order Number DE83003631.

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Sixteen landfill test cells (lysimeters) were constructed, each to hold approximately 0.80 m^3 (1 yd^3) of shredded refuse. The lysimeters were located above ground on a concrete slab in an enclosed, temperature-controlled room. The purpose of the project

was to evaluate environmental variables that have been proposed to enhance methane production. The four variables investigated were accelerated moisture addition, leachate recirculation, pH control/ buffer addition, and nutrient addition. Domestic municipal refuse was shredded to a particle size of 38 to 64 mm, mixed with dry chemical additives in selected cells, and compacted. The dry chemical additives included ammonium phosphate (added as nutrient) and calcium carbonate (added as buffer). Variable quantities of infiltration water were added tp different cells each month to identify the gas-enhancement value of accelerated moisture addition. Leachate removed each month was recirculated into selected lysimeters to identify the value of this technique in the sense of adding moisture and retaining nutrients. Results indicate that significant amounts of methane were generated in the majority of the test cells. Methane production was greatest in the leachate-recycle cells, and low in most nonrecycle cells, regardless of variables such as buffer addition, nutrient addition, or high infiltration. No significant differences in methane generation were observed between the recycle cells with either nutrient or buffer additives. After 2 years, methane levels were lower than the expected range of 40 to 60%.

11960 **(DOE/ET/14809—12) Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982.** Bartholomew, C.H. (Brigham Young Univ., Provo, UT (USA)). 6 Oct 1982. Contract AC22-79ET14809. 48p. NTIS, PC A03/MF A01. Order Number DE83004347.

Portions of document are illegible. Printed copy available until stock is exhausted.

During the third year the preparation of boride-promoted catalysts was improved, resulting in more active catalysts. Unsupported and 15% iron on silicalite catalysts were also prepared. Moessbauer spectra were obtained for several iron catalysts which showed that catalysts prepared from carbonyls yield higher metal dispersions. Activity/selectivity tests on iron and cobalt catalysts show that boride-promoted cobalt catalysts exhibit a high selectivity to C_6 to C_{18} hydrocarbons. Zeolite-supported iron catalysts show promise as producers of chemical feedstocks. In situ poisoning tests produced a linear loss of activity with increasing sulfur coverage. The addition of potassium or boron extends the life of Fe/SiO_2 catalysts; indeed an iron boride catalyst showed only 5% deactivation after five days. 20 figures, 6 tables.

11961 **(DOE/PC/30298—T9) Soot formation in synthetic-fuel droplets. Eighth quarterly technical progress report, July 1-September 30, 1982.** England, G.; Kramlich, J.; Kwan, Y.; Payne, R. (Energy and Environmental Research Corp., Irvine, CA (USA)). Nov 1982. Contract AC22-80PC30298. 24p. NTIS, PC A02/MF A01. Order Number DE83004183.

The purpose of this present research program is to investigate the details of soot formation from liquid fuel droplets and to provide information on methods of minimizing soot formation during synthetic liquid fuel combustion under conditions which minimize the formation of nitric oxides. The program comprises two main tasks, Fuel Screening Studies and Flame Studies. The purpose of the first task is to investigate the impact of fuel properties on particulate production, to establish the importance of droplet size and examine atomizer effects, and to develop techniques for surrogate fuels production. In the second task, fundamental details of soot formation from synfuel droplet combustion will be investigated in variable slip velocity configurations. During the past quarter, no new experimental effort has been initiated in the fuels screening (Task 1) section of this program. In the Task 2 - Droplet Studies - phase of the program, the experimental effort has been largely completed. In the present reporting period the soot yields for the various test fuels were obtained in the microspray reactor. In addition, a number of parametric tests were performed in which the sensitivity of soot yield to various combustion parameters was studied. 11 figures, 1 table.

11962 **(DOE/PC/40077—4) Liquid-hydrocarbon fuels from syngas. First annual report, March 1981-February 1982.** (Union Carbide Corp., Tarrytown, NY (USA). Tarrytown Technical Center). 1982. Contract AC22-81PC40077. 33p. NTIS, PC A03/MF A01. Order Number DE83004091.

Results produced during the year ending February, 1982, are presented. The objective of the contract is to develop a catalyst and to select operating conditions for the direct conversion of syngas to liquid hydrocarbon fuels, using microporous crystals - molecular sieves - in combination with transition metals. In Task 1, shape-selective catalysts (SSC's) will be evaluated for converting low molecular weight liquids (e.g. methanol and small olefins) to desired products such as gasoline, turbine and diesel fuel. In Task 2, the feed will be syngas ($CO + H_2$), and the catalyst will be a combination of transition metal component (MC) and SSC. Task 3 is a study of surface effects and reaction intermediates during the hydrogenation of carbon monoxide. A number of catalysts of different structure have been prepared at various levels of acidity to aid in selection of the SSC component. During the first year of the program, equipment was assembled to enable fairly rapid testing of candidate catalysts at a variety of conditions. Fairly complete data are available from two runs made during the second and third quarters of the contract, using a UCC Berty reactor. The first run used methanol feed over a high silica zeolite catalyst, and resulted in making products in the gasoline boiling range. The second preliminary run used iron as the Fischer-Tropsch active component, supported on a relatively inert amorphous silica-alumina base. This was a Task 2 run, with syngas as the feed. Although the fraction of feed connected to hydrocarbons was rather low, the fraction of that which was undesired solid was much less than with methanol feed. (DMC)

11963 **(DOE/PC/40077—5) Liquid-hydrocarbon fuels from syngas. Quarterly report, March 1982-May 1982.** (Union Carbide Corp., Tarrytown, NY (USA). Tarrytown Technical Center). 1982. Contract AC22-81PC40077. 83p. NTIS, PC A05/MF A01. Order Number DE83004092.

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The objective of this contract is to develop a catalyst and to select operating conditions for the direct conversion of syngas to liquid-hydrocarbon fuels, using microporous crystals - molecular sieves - in combination with transition metals. The work on the program is divided into four tasks. In Task 1, shape-selective catalysts (SSC's) are being evaluated for converting low molecular weight liquids such as methanol and propylene to desired products ike gasoline, turbine and diesel fuel. In Task 2, the feed is syngas ($CO + H_2$), and the catalyst is a combination of transition metal component (MC) and SSC. Task 3 is a study of surface effects and reaction intermediates during the hydrogenation of carbon monoxide, carried out as a subcontract under the direction of Dr. Gabor A. Somorjai, of U.C. Berkeley. Task 4 is a series of management and technical reports. Preliminary work with methanol and propylene (plus hydrogen) is reported. Also the preparation and activation of such catalysts are discussed.

11964 (PNL-SA—10646, pp 202-229) **Development of an indirectly heated pyrolysis reactor.** Clements, L.D.; Jeffery, J.P. (Texas Tech Univ., Lubbock). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

The status of several tasks involved in the development of a novel indirectly heated pyrolysis reactor is reviewed. The basis of the reactor concept is use of ceramic fire tubes internal to the reactor as an energy source and the reliance upon radiative rather than convective heat exchange as the primary energy transport mechanism. The bulk of the paper describes the design, construction, operation and data reduction methods for a new type of thermogravimetric analysis (TGA) unit which relies upon radiant heating. Results in the form of a new data analysis technique, TGA curves for SOLKA-FLOC (pure cellulose) and wood samples, and kinetic parameters under radiant pyrolysis conditions are presented. The mathematical model and kinetic data form one of the keys to providing the fire tube reactor concept with a sound technical basis.

11965 (SAND—82-8882, pp 7-32) **Toward a comprehensive chemical kinetic mechanism for the oxidation of acetylene: comparison of model predictions with results from flame and shock tube experiments.** Miller, J.A.; Mitchell, R.E.; Smooke, M.D.; Kee, R.J. (Sandia National Labs., Livermore, CA). Oct 1982. NTIS, PC A08/MF A01.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

A chemical kinetic model for the oxidation of acetylene is presented. the model is used to calculate flame speeds for adiabatic, freely propagating flames, composition profiles for lean and moderately rich burner-stabilized flames, and induction times and exponential growth constants for shock induced ignition. These results are then compared to the corresponding experimental results currently available. Rate coefficient inforation is derived predominantly from reaction-specific experiments. Since the comparisons made here are generally favorable, the kinetic model is consistent with a very large body of experimental, and in some cases theoretical, information. Important aspects of the reaction mechanism are discussed. 7 figures, 1 table.

11966 (SERI/CP—234-1590, pp 293-302) **Oxygen-blown entrained-flow gasification of wood.** Cousins, W.J. (DSIR, Lower Hutt, New Zealand). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

A 5 kg/h oxygen-blown entrained-flow gasifier for wood has been operated. From a feed of dry sawdust it gave a gas that consisted mostly of CO, H_2, and CO_2 in the volume ratio 1.8:1:1. The most important operating variables were the oxgyen/wood input ratio and the wood moisture content, but neither variable caused rapid change in either gas quality or quantity. There was, however, considerable variation in the gasifier internal temperature which increased with the oxygen/wood ratio. Water-gas shift equilibrium did not seem to be reached except possibly when the gasifier temperature was high.

11967 (SERI/CP—234-1590, pp 303-311) **Pressurized oxygen blown fluidized bed gasification of wood.** Chrysostome, G.; Lemasle, J.M. (Creusot-Loire, LeCreusot, France). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

The Creusot-Loire Co. of France has operated an oxygen blown fluidized bed wood gasifier at atmospheric pressure using 100 to 150 kg/h of dry substance. A description of the experimental unit, operating conditions, and gas product composition is given. Based on the experience with atmospheric gasification, studies are being undertaken to implement a demonstration unit permitting the gasification of 60 tons per day of wood under a 15 bar pressure. A brief description of the process and theoretical gas yields of this unit is given. (CKK)

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 11598, 11658, 11659, 11763, 11955, 12016, 12024, 12025, 12026, 12028, 12029, 12030, 12032, 12033, 12034, 12035, 12036, 12037, 12038, 12039, 12042, 12045, 12048, 12053, 12054, 12055, 12056, 12061, 12074, 12084, 12090, 12091, 12099, 12100, 12103, 12480, 12617, 12652, 12653, 12654

11968 (CONF-801030—Vol.3, pp 1043-1045) **Low energy motor fuel grade alcohol distillation systems.** Katzen, R.; Frank, B.; Gionnoni, V.T. (Nordon Industrias Metalurgicas S/A, Sao Paulo, Brazil). Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Based on existing technology and applying petrochemical concepts, we have developed distillation systems for highly efficient recovery of alcohol from synthetic and fermentation feedstocks, seeking specifically low energy consumption. Our distillation systems for production of motor-fuel grade alcohol - anhydrous as well as hydrous - are presented. The main characteristics of these systems are high recovery efficiency of the motorfuel grade alcohol and low consumption of energy with total utilization of bagasse.

11969 (CONF-8108141—, pp 198-218) **Potential synergisms resulting from the use of methanol in gasoline.** McCurdy, G.; Schieler, L.; Hill, W.L.; Utrera, W.J. (Carson Associates, Carlisle, MA). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

This paper considers aspects of the utility of methanol blended with gasoline and sketched the nature of the non-linear vapor pressure phenomena associated with such blends. It is the author's belief that widespread use of blends would be beneficial in terms of energy conservation, improved air quality, and greater yields of transportation fuel from low grade crudes. Further, the use of a mixed strategy of simple methanol blends, blends which use methanol and cosolvent alcohols, and MTBE can permit a wide variety of vapor pressure tailoring strategies for varying geographic and climatic conditions. Also, some processing efficiency improvements seem feasible. The use of methanol in this way can promote the commercial introduction of neat methanol automotive fuel by increasing its availability for fleet use and development of more advanced engines pending the commercial introduction of price competitive methanol derived from coal.

11970 (DOE/CS/83001—T1) **Catalysts for alcohols from biomass.** Klier, K.; Herman, R.G.; Simmons, G.W. (Lehigh Univ., Bethlehem, PA (USA). Center for Surface and Coatings Research). 8 Nov 1982. Contract AC02-80CS83001. 12p. NTIS, PC A02/MF A01. Order Number DE83003611.

This research aims at the development of catalysts for direct synthesis of light alcohols from synthesis gas produced by gasification of biomass. The specific goals of this research are (A) to determine the factors influencing the varying performance of copper-based catalysts for methanol in feedstocks with varying concentrations of carbon dioxide, and (B) to develop catalysts for the synthesis of C_2-C_4 alcohols by such modifications of the methanol synthesis catalysts that promote carbon-carbon bond formation among the mono-carbon intermediates. As the CO_2/CO ratio was varied, a pronounced maximum of the synthesis rate was observed at CO_2/CO ratio was varied, a pronounced maximum of the synthesis rate was observed at $CO_2/CO/H_2$ = 2/28/70 vol %, and as the ratio increased, the quantity of water in the exit gas increased. This observation indicated that the reverse water gas shift reaction was occurring, along with the methanol synthesis reaction. Therefore, the influence of water in the inlet synthesis gas on the methanol yield is being investigated. A comparison of the CO_2 experiments with the preliminary data obtained from the H_2O addition indicates that water behaves as a more effective promoter at low concentrations and as a more severe retardant at high concentrations than does carbon dioxide at comparable conditions. A number of approaches have been tried in attempting to promote carbon-carbon bond formation so that a selectivity to C_2-C_4 alcohols would be generated. Since iron is known to exhibit high activity as an alkyl-forming agent, a series of Fe/Cu/ZnO catalysts have been prepared. These ternary catalyst have been prepared by coprecipitation, and they show promise as alcohol fuel catalysts.

11971 (DOE/ER/10878—T1) **Conversion of cellulose to ethanol by mesophilic bacteria. Progress report and third year budget.** Canale-Parola, E. (Massachusetts Univ., Amherst (USA)). 24 Nov 1982. Contract AC02-81ER10878. 7p. NTIS, PC A02/MF A01. Order Number DE83004389.

Much of our research has dealt with eight strains of obligately anaerobic bacteria that we isolated from various natural environments as described in last year's progress report. These eight strains (referred to as C strains) are strains of mesophilic, spore-forming, rod-shaped bacteria that ferment cellulose with production of ethanol. We determined quantitatively the fermentation products formed by C strains from cellulose and various other carbohydrates. In all cases ethanol was produced, as well as acetate, CO_2 and H_2. The C strains utilized, for ethanol production and growth, a variety of cellulosic substrates ranging from paper to alpha-cellulose. Enzymatic assays and growth studies showed that C strains possessed a cellulose system consisting of endoglucanase, exoglucanase, and cellobiase components. Studies indicated that growth substrates have a regulatory effect(s) on components of the cellulase system of the C strains. another experimental approach is aimed at cloning cellobinse, endoglucanase and exoglucanase genes from the C strains into a suitable vector plasmid and, eventually, at introducing the plasmid into cells of Zymomonas mobilis. The objective of this part of our research is to obtain a Z. mobilis strain

capable of fermenting cellobiose and/or cellulose. Plasmids that contained DNA inserts were used to transform E. coli C600 recA. E. coli transformants that had acquired the cellobiase gene were obtained by this procedure. At present, we are attempting to introduce into Z. mobilis cells the vector plasmid purified from the E. coli transformants. In another series of experiments, we have used a new selective procedure to isolate four additional strains of mesophilic, obligately anaerobic, cellulolytic bacteria from natural environments.

11972 **(DOE/ID/12325—4) Methanol production from fermentor off-gases. Final report, July 1, 1981-June 30, 1982.** Dale, B.E.; Moreira, A.R. (Colorado State Univ., Fort Collins (USA)). 1982. Contract FG07-81ID12325. 22p. NTIS, PC A02/MF A01. Order Number DE83005011.

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The off-gases from an acetone-butanol fermentation facility are composed mainly of CO_2 and H_2. Such a gas stream is an ideal candidate as a feed to a methanol synthesis plant utilizing modern technology recently developed and known as the CDH-methanol process. A detailed economic analysis for the incremental cost of a methanol synthesis plant utilizing the off-gases from an acetone-butanol fermentation indicates a profitable rate of return of 25 to 30% under the most likely production conditions. Bench-scale studies at different fermentor mixng rates indicate that the volume of gases released during the fermentation is a strong function of the agitation rate and point to a potential interaction between the volume of H_2 evolved and the levels of butanol present in the final fermented broth. Such interaction may require establishing optimum operating conditions for an integrated butanol fermentation-methanol synthesis plant.

11973 **(DOE/ID/12332—T1) Development of high alcohol tolerant organisms. I. Strain selection and screening. Annual report, 31 July 1981-1 August 1982.** Bayne, P.D. (INCELL Corp., Milwaukee, WI (USA)). Dec 1982. Contract FG07-81ID12332. 162p. NTIS, PC A08/MF A01. Order Number DE83005260.

The principal objective of this study is the selection and development of an alcohol tolerant microorganism strain which will allow less water to be removed from the fermented beer, thus allowing the more energy efficient production of fuel alcohol. The program resulted in the selection of an outstanding strain of Zymomonas (B-10) for further evaluation in pilot scale fermentations and development by both mutagenesis and continuous selection. One culture strain of yeast and a number of mutant and variant strains of yeast await further evaluation for possible use as high alcohol tolerant strains in the production of power alcohol. Most important of all, the results of this investigation suggest a genetic basis, not a biochemical one, for strain differences in alcohol tolerance. It is our belief that a rational program of mass mutagenesis and screening will afford superior strains just as in the development of antibiotic yields. The automation and standardization of these mutagenic and selective regimes will allow larger samples to be screened and detect tolerance differences with greater sensitivity. Elimination of carbon diversion and increasing ethanol production rates and yields appear to be possible from the preliminary work conducted. Where several natural lines yield more tolerant strains by these procedures, genetic crossing, possibly using in vitro genetic chemical methods to circumvent natural barrier mechanisms, such as polyploidy, could result in derivatives with even greater tolerance.

11974 **(DOE/RA/50298—T1-Bk.2) Feasibility study of a 40-MGY/80-MGY fuel alcohol production plant. Equipment data: vendor correspondence and catalog cuts.** (Sverdrup/Sverdrup Technology, Inc., Tullahoma, TN (USA)). Aug 1982. Contract FG07-81RA50298. 313p. NTIS, PC A15/MF A01. Order Number DE83004781.

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The purpose of this study was to assess the feasibility of construction and operation of a 40 to 80 million gallon per year (MGY) fuel alcohol production plant at a site along the Coosa River in Talladega County, Alabama, about 50 miles from Birmingham. This volume contains a compilation of vendor's quotes and cataloger cuts pertaining to equipment selected for the process. The information is presented under the following headings: storage tanks; truck and railroad car loading; process water; chilled water system; cooling water system; tanks; heat exchangers; and pumps. (DMC)

11975 **(DOE/RA/50298—T1-Vol.1) Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 1. Executive overview.** (CfC, Inc., Dayton, OH (USA); Smith-Murray and Associates, Birmingham, AL (USA)). Aug 1982. Contract FG07-81RA50298. 97p. NTIS, PC A05/MF A01. Order Number DE83004807.

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The purpose of this study was to assess the feasibility of construction and operation of a 40 to 80 million gallon per year (MHY) fuel alcohol production plant at a site along the Coosa River in Talladega County, Alabama, about 50 miles from Birmingham. The scope of the study included examination of the physical and logistic supply considerations, and the practical utility of incorporating certain installations at or near the site as the result of past operations of a commercial synthetic fiber plant and the US Army's Alabama Ordnance Works (A.O.W.), both now inactivated. These installations include a power plant, water treatment plant and pumping stations, secondary sewage treatment and collection system located on the land owned by the county, as well as two large copper distillation columns and associated equipment formerly used to rectify alcohol and ether at A.O.W. The site also contains access roads and rail spurs. Along with a reference base plant design, the study contains analyses of economic/financial costs and operational viabilities based primarily on corn and sweet sorghum as input feedstocks, and environmental factors, including health, safety, and socio-economic impacts. Based on a 20-year life model for a base-line corn feedstock plant with reasonable interest and escalation values, the total investment costs, ROI, and payback periods are computed to be, respectively, $124 million, 53%, 4.1 years for the 40 MGY plant, and $222 million, 60%, 3.6 years for the 80 MGY plant. Many other economic projections, including debt burden, cash flow, operating costs, market estimates, system sensitivities, etc. are also presented. A two-year construction schedule is envisioned. Construction and operational feasibility, socio-economic impact, and investment return seem eminently favorable for this facility.

11976 **(DOE/RA/50298—T1-Vol.1-App.) Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 1. Appendices. Executive overview.** (Information Resources, Inc., Washington, DC (USA)). Sep 1982. Contract FG07-81RA50298. 180p. NTIS, PC A09/MF A01. Order Number DE83004780.

The results of a study to determine the technical and economic feasibility of constructing and operating a 40 to 80 million gallon per year alcohol fuels plant in Talladega County, Alabama are presented. This volume briefly outlines the transformation of the US fermentation industry since its inception in 1979; identifies the current status of the ethanol industry including its existing resources and markets; assesses the most important factors which will effect the development of the industry; and provides an assessment of the impact of GRASP's proposed facility on the US ethanol market. In addition, this document contains 7 appendices entitled: total US ethanol production capacity; US gasohol sales; regional refineries; fermentation ethanol imports for fuel use; state excise tax exemptions; alcohol fuels industry report; and US corn production and prices. (DMC)

11977 **(DOE/RA/50298—T1-Vol.2) Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 2. Technical concept.** (Sverdrup Technology, Inc., Tullahoma, TN (USA); Brock and Blevins Co., Inc., Rossville, GA (USA)). Aug 1982. Contract FG07-81RA50298. 311p. NTIS, PC A14/MF A01. Order Number DE83002204.

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The results of a study to determine the technical and economic feasibility of constructing and operating a fuel grade ethanol plant in Talladega County, Alabama are presented. The conceptual design of the plant is included. The site for the proposed plant was originally part of the Alabama Ordnance Works (AOW). The potential for utilizing surplus distillation equipment and other inactive AOW facilities (power plant, water treatment plant, and water pumping station) was investigated. The process description, major

equipment, site plan, construction schedule, and operating costs are discussed. (DMC)

11978 **(DOE/RA/50298—T1-Vol.3) Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Market survey and economic analysis.** (Sverdrup/Sverdrup Technology, Inc., Tullahoma, TN (USA); Harmon Engineering and Test Co., Inc., Auburn, AL (USA)). Aug 1982. Contract FG07-81RA50298. 128p. NTIS, PC A07/MF A01. Order Number DE83004772.

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A market survey was conducted to determine the supply and demand characteristics of the feedstocks, products, and by-products for a proposed 40-MGY fuel alcohol plant near Childersburg, Alabama. The scope of work for the market analysis encompassed the following areas: market evaluation of feedstocks considering availability, price, and acquisition methods over the life of the project; evaluation of market factors affecting choice of process fuel, with emphasis to be placed on local availability of coal; survey of markets for ethanol, dried distiller's grains with solubles (DDG/S), and carbon dioxide; and development of an overall market profile of the proposed project.

11979 **(DOE/RA/50298—T1-Vol.3-App.) Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Appendices. Market survey and economic analysis.** (Sverdrup/Sverdrup Technology, Inc., Tullahoma, TN (USA)). Aug 1982. Contract FG07-81RA50298. 305p. NTIS, PC A14/MF A01. Order Number DE83004784.

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The purpose of this study is to assess the technical and economic feasibility of constructing and operating an ethanol fuel plant in Talladega County, Alabama. This volume of appendices contains data resulting from marketing surveys and economic studies. Information is presented under the following headings: crop production and projections; grain movement; grain handling; letters of interest; composition of grains; grain price analysis; linear programming grain feedstock model land resource base; supplies of process inputs; coal producing regions in Alabama; composition of coal; coal prices; potential wood-waste supplies; alcohol projects; gasohol jobbers in Alabama; marketing to the military services; defense contracts for possible direct gasohol purchase; transportation guidelines; results of telephone survey of gasohol marketers in Alabama; alcohol fuels incentives; operating refineries in the US; distillers dried grains with solubles; carbon dioxide manufacturing plants; and permit requirements. (DMC)

11980 **(DOE/RA/50298—T1-Vol.4) Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 4. Environmental, health, safety, and socioeconomic assessment.** (Sverdrup/Sverdrup Technology, Inc., Tullahoma, TN (USA); Harmon Engineering and Test Co., Inc., Auburn, AL (USA)). Aug 1982. Contract FG07-81RA50298. 221p. NTIS, PC A10/MF A01. Order Number DE83004773.

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The environmental health, safety, and socioeconomic assessment for the proposed ethanol plant has been thoroughly analyzed. In general, there will be no long-term adverse effects to the environment from either the construction or the operation of the plant. No archaeological or historical sites will be disturbed. The yearly payroll of $4,000,000, the 160 jobs, the increased retail sales, additional taxes, and possible spin-off opportunities will be a continuing boost to a depressed local economy. The area already has adequate housing and should have no difficulty in providing the goods and services required. Overall the plant will be a definite asset to the area.

11981 **(INIS-SU—121) Chemical education and chemical literature. Problems of chimization of agriculture. Problems of wood chemistry. V. 6.** (AN SSSR, Moscow). 1981. 269p. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83780238.

From 12. Mendeleev's congress on general and applied chemistry; Moscow, USSR (1981).

Selected papers are indexed separately.

11982 **(IS-T—1011) Kinetics and mechanism of methanol decomposition over zinc oxide.** Tawarah, K.M. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 111p. NTIS, PC A06/MF A01. Order Number DE83004973.

Thesis. Submitted to Iowa State Univ., Ames.

The kinetics of CH_3OH decomposition over ZnO was studied in the temperature ranges: 453 to 513°K, and 563 to 613°K. In the first range, CH_3OH decomposed to H_2 and CH_2O, while concurrent decomposition of CH_3OH and CH_2O to H_2, CO, and CO_2 occurred in the second range. Production of CO_2 was believed to be a side reaction resulting from the decomposition of a formate species. The effect of P(CH_3OH) on the initial rate of production of H_2, R(H_2), and (CO + CO_2), R/sub c/, is given by the equation: [P/sub m//R/sub i/]/sup 1/2/ = a + bP/sub/m/. No inhibition was observed for H_2, CO, or CO_2. At 500°K, CH_3OH decomposed about 10 times faster than CH_2O. Comparison of the initial rates of decomposition of CH_3OH, CH_3OD, and CD_3OD in the low and high temperature ranges indicated that R/sub i/(CH_3OH) = R/sub i/(CH_3OD) > R/sub i/(CD_3OD). The proposed mechanism assumes that the rate of the low temperature CH_3OH decomposition is determined by that of the step: CH_3O^* + H* → CH_2O/sub (g)/ + H/sub 2(g)/ + 2*, while the high temperature decomposition is governed by the step: CHO* + H* → H_2/sub 2(g)/ + 2*. The low temperature decomposition has the apparent activation energies: E/sub app.)/ (CH_3OH) = E/sub app./(CH_3OD) = 89.0 kJ mol^{-1}, and E/sub app./(CD_3OD) = 95.7 kJ mol^{-1}. The high temperature decomposition gave a break in the Arrhenius plot of ln R/sub c/ versus 1/T at ~ 590°K. This was attributed to the decrease in the equilibrium constants, appearing in the rate law, with increasing temperature. Below 590°K, the apparent activation energies are: E/sub app./(CH_3OH) = E/sub app./(CH_3OD) = 127.1 kJ mol^{-1}, and E/sub app./(CD_3OD) = 175.4 kJ mol^{-1}. 21 figures, 4 tables.

11983 **(SERI/CP—234-1590) Biomass-to-methanol specialists' workshop.** Reed, T.B.; Graboski, M. (eds.). (Solar Energy Research Inst., Golden, CO (USA); Colorado School of Mines, Golden (USA)). 1982. Contract AC02-77CH00178. 345p. (CONF-820324—). NTIS, PC A15/MF A01. Order Number DE82022032.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

Portions of document are illegible.

This workshop dealt with a technology assessment of current methanol manufacture, recent developments in coal and peat technology, the preparation of biomass and peat for synthesis gas production, US and foreign projects involved in the gasification of biomass and the development of associated equipment, and the use of methanol as a fuel. Separate abstracts were prepared for selected papers. (CKK)

11984 (SERI/CP—234-1590, pp 5-25) **Methanol synthesis.** Klier, K. (Lehigh Univ., Bethlehem, PA). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

The low pressure methanol synthesis is an attractive terminal stage of biomass-to-methanol flow diagram. Selection of catalysts, reaction kinetics in the presence of carbon dioxide, the preparations of the copper-zinc oxide catalysts, and mechanistic routes to low alcohols are reviewed herein to demonstrate that the operating conditions and models for methanol synthesis are well experimented out and that sound chemical principles may be used for steering the synthesis to C_2-C_4 alcohols. The latter goal has not been realized on a commercial scale, however, and requires further catalyst optimization.

11985 (SERI/CP—234-1590, pp 27-32) **Chem Systems' Liquid Phase Methanol process.** Frank, M.E. (Chem Systems Inc., New York, NY). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

Chem Systems' Liquid Phase Methanol (LPMeOH) process differs significantly from presently available technologies. This process incorporates an inert hydrocarbon liquid into the reactor in the presence of a heterogeneous catalyst to effect high conversions

of hydrogen and carbon monoxide to methanol. The liquid serves to control the reaction temperature by converting the sizable reaction exothermicity into a moderate temperature gain and allows maximum recovery of this reaction heat for use in the overall process. The LPMeOH process is particularly suited for coal-derived synthesis gases which are usually hydrogen deficient. Development work has been underway for several years, initially under the sponsorship of the Electric Power Research Institute. The process is ready to move to the pilot plant stage. The Department of Energy (DOE) will provide support for this phase of the project on a cost-sharing basis with others. A skid-mounted pilot plant previously used for testing Chem Systems' Liquid Phase Methanation/Shift process will be adapted for testing the LPMeOH process. The pilot plant will be located at Air Products and Chemicals Inc.'s LaPorte, Texas synthesis gas plant. APCI will provide a major role in this program.

11986 (SERI/CP—234-1590, pp 33-39) **Packaged plants.** Gage, S.J. (International Harvester Co., Burr Ridge, IL). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

The concept of a packaged plant is discussed. A packaged plant is a process unit based on a standard design and size, fabricated in a shop and shipped as modules to the installation site. Smaller than site erected processing plants, packaged plants have the advantage of being less costly, independent of weather, more reliable in quality control, materials control, and operation, less prone to the risks of under utilization of capacity or technical obsolescence, and more prone to being located close to the end use markets and raw material supplies, in addition to being able to be installed in parallel when increased capacity is required. The application of the packaged plant concept to the biomass-to-methanol production process is particularly advantageous because of the characteristics of biomass as a feedstock (low concentration in any one area) and the methanol market dynamics (sensitivity to production cost, to demand and supply disruptions, to transportation and capital investment costs.). (CKK)

11987 (SERI/CP—234-1590, pp 175-177) **Large wood to methanol plants.** Stevenson, W.A. (Evergreen Energy Corp., Waltham, MA). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

Evergreen Energy Corp. and Texaco, Inc. have agreed to cooperate in the modification of the Texaco high-pressure coal gasification process to accept wood as a feedstock. The proposed production facility will be sited in New England to take advantage of the over abundance of low-grade, non-merchantable wood in the region and of the complete dependence of the New England states on imported energy. The plant will produce 330,000 gallons of methanol per day from 3500 tons of green wood chips. The main end use of the methanol will be as a gasoline additive and octane booster, but it also will be sold as a chemical feedstock for the production of formaldehyde resins. (CKK)

11988 (SERI/CP—234-1590, pp 231-238) **Pressurized fluidized bed gasifier in the synthesis of methanol from wood.** Black, J.W. (Omnifuel Gasification Systems, Toronto, Ontario). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

Very good heat transfer rates are possible in fluidized bed gasifiers, and when used for biomass, tend to promote rapid pyrolysis of the biomass resulting in a significant production of short chain hydrocarbons. Performance data from an air-fired fluidized bed gasifier at a plywood mill in Ontario is given which confirms the high hydrocarbon production. This data is compared with the predicted performance of an oxygen-fired gasifier. A typical process of the production of methanol from wood is described. The process consists of a gasifier, steam reformer, shift converter, a CO_2 absorption system, a synthesis reactor containing the catalyst, and a methanol separator. A trade-off is necessary to obtain a synthesis gas lower in hydrocarbons. A catalyst added to the fluidized bed could reform some of the methane; however, additional oxygen would be required. A review of the costs of oxygen production and reforming is given which shows that the elimination of the reformer is equal to about 25% increase in the oxygen plant capacity. Capital cost for a 300 T/d methanol plant is tabulated. (LCC)

11989 (SERI/CP—234-1590, pp 239-259) **Methanol from wood and peat.** Waldheim, L.; Rensfelt, E. (STUDSVIK ENERGITEKNIK AB, Nykoeping, Sweden). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

Due to the lack of domestic petroleum resources and natural gas in Sweden, the interest for use of biomass as raw material for production of methanol arose soon after the 1973 oil crisis. Gasification is the missing step for the commercial production of methanol from biomass. Feasibility studies during 1979 showed that oxygen blown gasification processes working below ash melting point had a distinct advantage over non-oxygen processes or processes working above ash melting point. Tars and methane from biomass pyrolysis need a higher reaction temperature for conversion than is needed for char gasification in a fluidized bed. The interest has therefore been centralized to two processes, the High Temperature Winkler and MINO, both being pressurized, two stage, oxygen blown processes. The HTW process has been studied as a short term development; the process operating conditions only needed to be adapted to the biomass fuel. During 1980 and 1981 a pilot plant atmospheric pressure gasifier was used to determine these conditions together with pressurized bench-scale experiments. The results are used for design of a demonstration plant in Sweden. The other process, MINO, is a longer term development, this process using a high temperature fly ash filter and a catalytic secondary stage for tar and methane conversion. Currently a pilot plant based on this concept is being built in Studsvik, and bench scale studies continue at the technical universities.

11990 (SERI/CP—234-1590, pp 261-276) **Biomass gasification developments.** Wilson, H.T.; Gibbins, J.R. (Foster Wheeler Power Products Ltd., London, England). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

Theoretical computer models were developed to investigate process parameters for the gasification of biomass. Results on the effect on methane content and theoretical methanol yield by steam/oxygen gasification and by pressure variations are shown. The design and operation of a wood gasification test facility is described. The 40 kg/h test facility was designed for an operating pressure of 30 bar and a maximum temperature of 1200°C. Feed is continuously batched into the reactor via a pressurized lock hopper system. Superheated steam up to 900°C is used in the steam only gasification studies. Preliminary findings have provided process insight so that a proposed 20 ton/day demonstration plant is also described. (CKK)

11991 **(NP-tr—3900765) Method for the preparation of a gaseous fuel.** (British Gas Corp., London). [nd]. Translation of Dutch Patent No. 7,812,292, December 19, 1978. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900765.

A method is claimed for the preparation of a gaseous fuel with a calorific value of at least 30 mega Joule/m^3. A mixture of carbon monoxide and hydrogen with an H_2/CO mol. ratio smaller than 1 is converted to a hydrogen-containing reaction mixture by bringing the H_2/CO mixture into contact with a mixture of two catalysts. One of the catalyst (catalyst A) comprises zinc and/or copper. It is able to catalyze the conversion of an H_2/CO mixture mainly into methanol and/or dimethyl ether. The other (catalyst B) is a crystalline silicate. The preparation of the hydrocarbon-containing reaction mixture should preferably be done at a temperature of 200 to 500°C, and pressure of 1 to 150 bar. The C_4^- fraction is separated from the hydrocarbon-containing reaction mixture, and the gaseous fuel is prepared from C_4^- fraction through the removal of at least one part of the CO_2 present in it.

0903 Inorganic Hydrogen Compound Fuels

REFER ALSO TO CITATION(S) 11955

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 12064, 12079, 12080, 12081, 12627, 12629, 12634, 12637

11992 (SERI/CP—234-1590, pp 83-89) **Technology of wood supply.** Rich, J.P. (J.P.R. Associates, Inc., Stowe, VT). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

Three areas of wood supply are discussed: harvesting systems; landowner attitude and public relations; and, mainly, the procurement of a steady wood supply. Wood fuels can no longer be considered as a pipeline quantity like coal or oil. Environmental concerns, capital costs of harvesting equipment, competition for wood fuels, and the need to deal with private landowners require industries to carefully staff and manage their wood procurement program. The experiences of two companies, Burlington Electric of Vermont and the S.D. Warren Co., of Maine, are described. (CKK)

13 HYDRO ENERGY

REFER ALSO TO CITATION(S) 12450

11993 **(PB—82-257676) Small scale hydropower development in Illinois: an implementation manual. Final report.** Lindsey, G. (Wapora, Inc., Chicago, IL (USA)). Dec 1980. 175p. NTIS, PC A08/MF A01.

This manual has been prepared to assist potential developers of existing dam sites in the implementation of small-scale hydropower projects. It is designed to guide developers in preparing preliminary estimates of site potential for hydropower generation and to aid them in addressing the institutional, regulatory, environmental, and financial aspects of implementation. The manual has been written especially for readers with non-technical backgrounds and for individuals newly acquainted with small-scale hydropower technology. Successful completion of the steps identified herein should enable a developer to determine accurately whether a detailed feasibility study performed by professional engineers--the next step in the development process--is economically justified.

1301 Resources And Availability

REFER ALSO TO CITATION(S) 11996

11994 **(PB—82-252057) Phase I report: inventory of potential small-scale hydropower sites in Illinois and selection of projects exhibiting potential for development. Final report.** Lindsey, G.; Kelly, G.M.; Sweeney, D. (Wapora, Inc., Chicago, IL (USA)). Jan 1981. 50p. NTIS, PC A03/MF A01.

This study of the potential for small-scale hydroelectric generation in Illinois, commissioned by the Illinois Institute of Natural Resources, reflects the logical first step by the State of Illinois in the development of this alternative energy source. Although the development of small-scale hydroelectric facilities (any hydroelectric generating facility with a capacity of 15 MW or less) in Illinois has the potential for increasing Illinois total generating capacity by only a small amount, the development of any hydroelectric power sources that are economical will represent progress. Any increase in the State's hydroelectric generating capacity will contribute to the reduction of the State's reliance on non-renewable energy sources.

1302 Site Geology And Meteorology

REFER ALSO TO CITATION(S) 12001

1304 Regulations And Licensing

11995 **(CONF-8011101—1) Hydroelectric power: renewed emphasis and expanded opportunities.** Williams, C.D. (American Public Power Association, Washington, DC). 12 Nov 1980. 17p. American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC.

From American Public Power Association legal seminar; Boston, MA, USA (10 Nov 1980).

A brief overview is presented of recent developments in legislation, regulations, and loan and grant program affecting small-scale hydroelectric power development.

1305 Economics And Management

11996 **(DOE/R5/10311—2) Report of investigation for hydroelectric generation. Final report.** Jacobson, R.O. (Jacobson (Ray O.), Pengilly, MN (USA)). 16 Nov 1982. Contract FG02-81R510311. 72p. NTIS (US Sales Only). Order Number DE83004798.

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This report presents the findings of a study commissioned by the Biwabik Public Utilities Commission in order to lower electrical costs to their consumers by utilizing local rivers for the generation of power. Northern Minnesota has many rivers and streams but has a relatively flat terrain. The principal power company of the area, Minnesota Power, does generate electricity from the St. Louis, Mississippi, Crow Wing, and Kawishiwi Rivers (approximately 6% of their total, the smallest hydroplant generating 1400 kW). Only existing dam sites were studied due to the high cost of new construction. They were selected as defined in the following pages. Manufacturers were contacted to obtain relative costs for turbines and the necessary equipment. Correlating the costs with the sites, it was discovered that even with today's cost of electricity, it was not feasible to develop any of the selected sites. The high cost of new generating equipment and the high interest rates make the generation of power from the low head/low flow sites uneconomical.

11997 **(DOE/RA/23211—4) Goodyear Lake hydroelectric generating station redevelopment. Final operating cost report.** (F.W.E. Stapenhorst, Inc., Pointe Claire, Quebec (Canada)). Oct 1982. Contract FC07-79RA23211. 34p. NTIS, PC A03/MF A01. Order Number DE83004753.

The Goodyear Lake how-head hydropower plant resulted from the rehabilitation of an old dam. The project construction costs were $1.722 million, which included a 17% overrun from original cost estimates due chiefly to extraordinary rates of inflation. For the first two years operating costs were $126,500 and $240,100 while revenues were $233,200 and $403,400, respectively. Revenues for year 1 were obtained from sales at 3 cents/kWh and for year 2 at 3.4 cents/kWh. If the rates payable by utilities under PURPA regulations, namely 6 cents/kWh, had been paid the revenues would have nearly doubled. It is concluded that initial cost overruns are not readily recuperable. (LCL)

1307 Power Conversion Systems

REFER ALSO TO CITATION(S) 12263

14 SOLAR ENERGY

11998 **(TENRAC/EDF—004) Texas Energy Development Fund. Project status reports.** (Texas Energy and Natural Resources Advisory Council, Austin (USA)). Jan 1979. 50p. NTIS, PC A03/MF A01. Order Number DE83900791.

Brief project status reports are presented for the following projects: lignite, geothermal, conservation, solar, wind, biomass, and special. (MHR)

1401 Resources And Availability

11999 (CONF-811175—) **Energy and special applications programme, report No. 2 (1981). Papers presented at the WMO technical conference on meteorology and energy.** (World Meteorological Organization, Geneva (Switzerland)). Sep 1981. 164p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE83900306.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

Portions of document are illegible.

Separate abstracts were prepared for 9 papers in this conference proceedings, and 17 abstracts of short papers were listed by title. One paper was previously abstracted for EDB. (LEW)

12000 (CONF-811175—, pp 83-92) **Principles of a probabilistic/statistical approach to the estimation of potential wind energy and solar radiation.** Aksarin, N.; Hartman, L.B. Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

Several statistical parameters are discussed, including energy and technical-economic indices defined by climatological characteristics for solar or wind power, principle statistical distribution characteristics (statistical moments and shapparameters, frequency distributions, and probability curves), and examples of effectiveness estimates for solar and wind energy use. (LEW)

12001 (CONF-811175—, pp 93-117) **Climate and energy.** McKay, G.A.; McKay, D.C. (Atmospheric Environment Service, Downsview, Ontario). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

The geographical variation of energy sources is described, along with reliability of supply and these factors are compared to projected usage. Both energy demand and renewable energy supply are functions of geography. Each economic activity makes very specific energy demands, such as for space heating and cooling as well as in operations. Many of these energy demands relate to climate either directly or in the sense of achieving system efficiency. The opportunities of enhancing efficiency is looked at from a viewpoint of siting and the design of buildings to achieve economy. The climatologist and ecologist often prefers to consider the total energy flow within the natural system. This latter viewpoint provides additional opportunities for the application of climatic knowledge. Supporting the use of natural energy flows is the cost of energy from other systems. Generally the total cost of such energy has not been fully understood. The environmental costs and the waste that is related to the use of many energy forms are matters of major concern. Both make conservation a highly desirable option. Conservation can be defined as the saving of primary fuels through alternatives and through efficiency. In both roles climate has a significant role to play. By promoting and making readily available information on alternatives and more efficient methods climatologists in a sense can help shape future energy policies.

12002 (CONF-811175—, pp 118-128) **Climate data for energy programmes.** McKay, G.A.; McKay, D.C. (Atmospheric Environment Service, Downsview, Ontario). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

Climate data have a multifaceted role in energy applications. Basic questions that must be addressed in the development of data are: who are the users, how do they use climate information, what meteorological parameters must be measured for them, what information or data sets are available, how can these data be transformed into usable information. Mechanisms for determining users and their required data include direct contact, workshops and inventories. In determining sources and the end use of the data the meteorologist must be pragmatic as to what can be provided. Frequently the client is unfamiliar with meteorological data and/or requires the data to be transformed into a specified form to fit his design criteria or operational program. Finally the user must have knowledge of what is available, easy access to data and advice on its interpretation, limitations and use.

12003 (CONF-811175—, pp 137) **Measurement and modelling of solar radiance.** Brevik, I.; Sandbakken, S.; Loevseth, J. (Univ. of Trondheim, Dragvoll, Norway). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12004 (CONF-811175—, pp 140-143) **Spectral measurements of solar radiation at the Royal Meteorological Institute of Belgium.** Dogniaux, R.A. (Royal Meteorological Inst. of Belgium, Brussels). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12005 (CONF-811175—, pp 144) **Global and diffuse solar radiation dependent on cloud amount and turbidity.** Kasten, F. (Deutscher Wetterdienst, Hamburg, Germany). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12006 (CONF-811175—, pp 145) **Optimum exposure of solar collectors with respect to atmospheric transmission of solar radiation.** Manes, A.; Yanetz, A. (Israel Meteorological Service, Bet-Dagan). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12007 (CONF-811175—, pp 147) **Comes action in solar meteorology.** Plazy, J.L. (Commissariat a l'Energie Solaire, Valbonne, France). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12008 (CONF-811175—, pp 148) **Analyses of meteorological and insolation data useful for solar energy system design.** Whitaker, S.D. (Solar Energy Research Inst., Golden, CO). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12009 (CONF-811175—, pp 149) **Swedish meteorologial programme related to solar and wind energy.** Bodin, S.; Dahlgren, L.; Kvick, T.; Olsson, L.E. (Swedish Meteorological and Hydrological Inst., Norrkoeping). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12010 (CONF-811175—, pp 153-154) **Solar and wind energy research in connexion to community and building planning.** Tammelin, B. (Finnish Meteorological Inst., Helsinki). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12011 (CONF-811175—, pp 157) **Climatic parameters for wind and solar power engineering.** Kobysheva, N.V.; Pivovarova, Z.I. Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12012 (DOE/ET/20356—7) **Cloud-cover estimation: use of GOES imagery in development of cloud-cover data base for insolation assessment.** Huning, J.R.; Logan, T.L.; Smith, J.H. (Jet Propulsion Lab., Pasadena, CA (USA)). 30 Nov 1982. Contract AI01-76ET20356. 118p. (JPL-PUB—82-101). NTIS (US Sales Only). Order Number DE83005142.

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It is the purpose of this study to verify the potential of using digital satellite data to establish a cloud cover data base for the United States, one that would provide detailed information on the temporal and spatial variability of cloud development. The study involves the use of four sequential days of GOES data (eighty acquisitions) over a predetermined test area, and converts those data into a computer archive of cloud cover, one that is accessible using predetermined grid cells of variable size. Key elements include: (1) interfacing GOES data from the University of Wisconsin Meteorological Data Facility with the Jet Propulsion Laboratory's VICAR image processing system and IBIS geographic information system; (2) creation of a registered multitemporal GOES data base; (3) development of a simple normalization model to compensate for sun angle; (4) creation of a variable size georeference grid that provides detailed cloud information in selected areas and summarized information in other areas; and (5) development of a cloud/shadow model which details the percentage of such grid cell that is cloud and shadow covered, and the percentage of cloud or shadow opacity. In addition, comparison of model calculations of insolation with measured values at selected test sites was accomplished, as well as development of preliminary requirements for a large-scale data base of cloud cover statistics.

12013 **(SOLAR/0010—80/01) January 1980 environmental data for sites in the National Solar Data Network.** (Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.). Jan 1980. Contract AC01-79CS30027. 233p. NTIS, PC A11/MF A01. Order Number DE83005516.

Environmental information collected at the sites of the National Solar Data Network is presented in the form of tables for each solar site. The sites are grouped into 12 zones, each of which consists of several adjacent states. The insolation table presents the total, diffuse, direct, maximum, and extraterrestrial radiation for the solar site. It also shows the ratio of total to extraterrestrial radiation. The temperature table gives the average, daytime, nighttime, maximum, minimum, and inlet-water temperatures for the solar site. All of the passive and some of the active solar sites are equipped with wind sensors which provide information for two wind tables furnishing wind speed and direction. For some sites, a humidity table provides relative humidity values for day and night. It also gives values for the maximum and minimum humidity for each day. A technical discussion of the instruments and measurements used to obtain these data tables is included. (LEW)

1403 Economics

REFER ALSO TO CITATION(S) 12020, 12640

12014 **(DOE/CS/30013—U12) Commercial energy costs for SOLCOST Data Bank cities, winter 1981-1982.** Holder, R.S. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Win 1982. Contract FG01-79CS30013. 250p. (UAH—329). NTIS (US Sales Only). Order Number DE83005339.

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Commercial fuel costs are listed for 305 cities included in the SOLCOST Data Bank. The commodities covered are electricity, natural gas, No. 2 fuel oil, and coal. For each city is shown: the 1980 population, the 30 year mean annual heating and cooling degree days based on 65°F, the mean daily solar radiation based on a global horizontal value, the company name for each commodity, and calculations for the cost of each commodity including all taxes and charges. Calculations are then made for cost per million Btu for each commodity. Weighted averages are calculated for each state, DOE Regional Solar Energy Center, the ten federal regions, and the United States. Cities and states are ranked according to cost of each commodity, and a collection of computer-generated graphic analyses of the data is presented. (LEW)

12015 **(DOE/NASA/20485—13) Worldwide market for photovoltaics in the rural sector.** Brainard, W.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1982. Contract AI01-76ET20485. 13p. (NASA-TM—83035; CONF-820906—37). NTIS, PC A02/MF A01. Order Number DE83005103.

From 16. IEEE photovoltaics specialists conference; San Diego, CA, USA (28 Sep 1982).

Three major studies were performed to determine the worldwide market for stand-alone photovoltaic-power systems in three specific segments of the rural sector. The three studies addressed the worldwide market for photovoltaic power systems for village power, cottage industry, and agricultural applications. The objectives of these studies were to: assess the market potential for small stand-alone photovoltaic-power system in specific application areas; identify technical, social and institutional barriers to PV utilization; identify funding sources available to potential users; and recommend marketing strategies appropriate for each sector to American PV product manufacturers. The studies were prepared on the basis of data gathered from domestic sources and from field trips to representative countries. This paper summarizes the results of these three studies. Both country-specific and sector-specific results are discussed, and broadly applicable barriers pertinent to international marketing of PV products are presented. Generic recommendations to American PV manufacturers of appropriate strategies for the international market in general are also made.

12016 **(DOE/RA/50338—1-Attach.B-Vol.3) Report on the engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc. at Thibodaux, Louisiana. Attachment B, Volume III. Definitive estimate. Section 1: terminal.** (Badger America, Inc., Tampa, FL; Tate and Lyle Technical Services Ltd., Coral Gables, FL (USA)). Apr 1982. Contract FG07-81RA50338. 148p. NTIS, PC A07/MF A01. Order Number DE83001186.

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A detailed definitive cost estimate is given for an ethanol/gasohol storage and blending terminal serving a planned distillery at a Louisiana sugar factory. Included are an analysis of the accuracy of the estimate, labor rates efficiency, materials and labor escalation, as well as detailed calculations for each account of the project. (LEW)

12017 **(TENRAC/EDF—006) Solar energy: an economic analysis. Part I and II. Final report.** Hill, L.E.; Jonish, J.E.; Teske, C.E. (Texas Tech Univ., Lubbock (USA)). Jul 1979. 212p. NTIS, PC A10/MF A01.

Portions of document are illegible.

An economic evaluation of solar energy use is made in four parts. A solar system that was installed in Lubbock, Texas in 1976 is examined for economic benefits under varying economic parameters. A sensitivity analysis examines three typical heating requirements with scenarios of varying interest and inflation rates, solar system costs, loan terms, and tax credits. An identical home with a solar system designed to provide energy for domestic hot water, space heating, and air conditioning is studied, followed by the economics of using solar energy to heat only domestic hot water. The economic analysis presented considers system life-cycle cost, and involves comparing the present values of the yearly capital and operating costs of a solar system with the yearly operating costs of a conventional system. Two legal considerations (property rights in solar applications and local building codes) and one institutional consideration (the attitudes of financial institutions) which might hamper the current and near term acceptability of solar energy are then examined. The existing financial incentives provided by the states to promote the acceptability of solar energy are examined. (LEW)

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 12017, 12046, 12047, 12125, 12126

12018 (CONF-811175—, pp 146) **Possible effects of solar energy conversion on meteorological conditions.** Nishinomiya, S.; Hashimoto, H. (Central Research Inst. of Electric Power Industry, Tokyo, Japan). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12019 (MTR—80W215-02) **Technology assessment of solar energy systems. Scenario development and methodology. Volume II.** Schiffman, Y.M. (Mitre Corp., McLean, VA (USA). METREK Div.). Jul 1981. Contract AC01-80EV10354. 218p. NTIS, PC A10/MF A01. Order Number DE83004890.

Portions of document are illegible.

Included are a general overview of the Technology Assessment of Solar Energy systems (TASE) project and a description of the study approach, the development of the TASE scenarios, energy and environmental assumptions, and assumptions and forecasts of the FOSSIL2 National Energy Model upon which the TASE scenarios were based. The Strategic Environmental Assessment System (SEAS) model was used to generate the analytical data base for TASE. Improvements made to SEAS to allow it to model solar and biomass energy technologies are also described.

12020 (MTR—80W215-03) **Technology assessment of solar energy systems. Socioeconomic impacts of solar deployment and conventional energy use. Volume III.** Gordon, J.J.; Tahami, J.E. (Mitre Corp., McLean, VA (USA). METREK Div.). Aug 1981. Contract AC01-80EV10354. 97p. NTIS, PC A05/MF A01. Order Number DE83004452.

This study presents an analysis of socio-economic impacts of conventional energy prices and solar technology use in the residential sector. Patterns of household energy use are explored as a function of income class. Impacts on household disposable income of use of conventional fuels and technologies as compared to solar alternatives are then assessed. This analysis is conducted for 1978 and 1990 by income class and region. Profiles of residential-solar-system purchases are presented and trends in the adoption of solar systems in this sector are discussed. Because income levels and certain demographic characteristics tend to be correlated, insights regarding the distribution of impacts among population groups can be obtained by examining the demographic composition of US households. Accordingly, socio-economic profiles of the US population are developed to help identify the demographic characteristics of households most severely affected by high energy prices, as well as of those households best able to reduce energy costs through the purchase of solar energy and conservation.

12021 (MTR—82W59) **Technology assessment of solar-energy systems. Materials resource and hazardous materials impacts of solar deployment.** Schiffman, Y.M.; Tahami, J.E. (Mitre Corp., McLean, VA (USA). METREK Div.). Apr 1982. Contract AC01-80EV10354. 90p. NTIS, PC A05/MF A01. Order Number DE83005048.

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The materials-resource and hazardous-materials impacts were determined by examining the type and quantity of materials used in the manufacture, construction, installation, operation and maintenance of solar systems. The materials requirements were compared with US materials supply-and-demand data to determine if potential problems exist in terms of future availability of domestic supply and increased dependence on foreign sources of supply. Hazardous materials were evaluated in terms of public and occupational health hazards and explosive and fire hazards. It is concluded that: (1) although large amounts of materials would be required, the US had sufficient industrial capacity to produce those materials; (2) the postulated growth in solar technology deployment during the period 1995-2000 could cause some production shortfalls in the steel and copper industry; (3) the U.S. could increase its import reliance for certain materials such as silver, iron ore, and copper; (4) however, shifts to other materials such as aluminum and polyvinylchloride could alleviate some of these problems.

12022 (NP—3900898) **Revised draft installation standards for solar-energy systems.** Chorn, K.S. (California Energy Resources Conservation and Development Commission, Sacramento (USA)). May 1982. 38p. California Energy Commission, 1516 Ninth Street, Sacramento, CA 95814.

The standards presented apply to solar water heating systems and active solar space heating and cooling systems. Permit requirements are specified, as well standards for collector installation, orientation, and certification, for ductwork and piping, for thermal storage, and for system controls. Requirements are specified for a consumer information package regarding a solar energy system. (LEW)

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 11658, 11739, 11956, 11964, 11966, 11967, 11968, 11970, 11971, 11972, 11973, 11974, 11975, 11976, 11977, 11978, 11979, 11980, 11981, 11983, 11984, 11986, 11987, 11988, 11989, 11990, 11992, 12016, 12107, 12480, 12510, 12546, 12627, 12652, 12653, 12654, 12733, 12811, 12816, 13127, 13134

12023 (AD-A—118268/2) **Laser spot scanning of photoelectrochemical cells. Technical report.** Langmuir, M.E.; Micheels, R.H.; Boudreau, R.A.; Rauh, R.D. (EIC Labs., Inc., Newton, MA (USA)). Aug 1982. 18p. (C—598; TR—5). NTIS, PC A02/MF A01.

Laser scanning of the photoelectrode in a photoelectrochemical cell is a powerful diagnostic tool for assessing the effect of surface modifications of the semiconductor electrode on cell performance. Photocurrent scan maps of photoelectrodes with external and/or white light bias allow the study of the effect of iR losses in the cell under operating conditions. A dye laser adds versatility to the system by permitting wavelength dependent responses to be mapped. The possibility of time resolved measurements, using a pulsed laser source, is also discussed.

12024 (CONF-801030—Vol.3) **IV international symposium on alcohol fuels technology.** (Instituto de Pesquisas Tecnologicas, Sao Paulo (Brazil)). Jan 1981. 335p. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Portions of document are illegible.

Twenty-four papers are included. A separate abstract was prepared for each one.

12025 (CONF-801030—Vol.3, pp 919-933) **Brazilian biomass utilization program, with emphasis on proalcool.** Vargas, J.I. (Industrial STI/MIC, Lote, Brazil). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Energy consumption in Brazil by sector and its consequences are discussed. Measures taken by the Brazilian government to achieve short and middle-term solutions are pointed out in a brief historical retrospect. Long-term programs are analyzed, with a central focus on discussion of liquid fuels. An extensive description of the national alcohol program and its technological, social and politico-economic effects, as well as an explanation of the preference for spark-ignition engines are given. Diesel engines require new alternatives. Thus, vegetable oils are placed in their true perspective, in terms of both their agricultural potential and their socio-economic impact.

12026 (CONF-801030—Vol.3, pp 945-951) **Assessment of environmental impacts of production, distribution and utilization of alcohol and biomass fuels.** Bertilsson, B.M. (Svensk Metanolutveckling AB, Stockholm, Sweden). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

An analysis is presented on the environmental implications of production, distribution and utilization of alternative fuels, with emphasis on methanol and ethanol derived from biomass or fossil

feedstock. A comparison with conventional fuels will be made. Areas in need of further investigation will be highlighted.

12027 (CONF-801030—Vol.3, pp 953-964) **Biomass: its utilization as food and/or fuel.** Rask, N. (Ohio State Univ., Columbus). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

An assessment of economic and strategic potential for energy-crop production and food-fuel competition is made. Specific national situations are compared and discussed. Impacts on world food supplies and prices are addressed.

12028 (CONF-801030—Vol.3, pp 983-986) **Non-enzymatic hydrolysis of carbohydrates.** Hugues, J.F. (Stanfer, Montreal, Quebec). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

The system is basically a physical chemical process and produces equivalent or better quality sugar solutions in very short reaction times, without regard to impurities in the starch slurry. In operation the starch laden slurry is acidified to a specific level and pumped at a high pressure (600 to 800 psig) into the hydrolysis reactor. The reactor consists of three parts. In zone one the preheat zone, the acidified starch slurry goes through three physical states. Initially, the slurry reacts to the heat by turning into a very viscous paste, once the slurry reaches approximately 120°C the viscosity drops to a level only slightly higher than that of water, and finally the slurry exhibits Newtonian fluid properties just before it reaches the nozzle. In zone two, the nozzle is essentially a venturi, its purpose is to control flow and maintain equilibrium within zone one. The nozzle accelerates the starch liquor and then ejects it into the lower pressure zone, zone three. In zone three or collector zone, the hydrolysis conversion to dextrose is completed before the liquor is discharged from the reactor.

12029 (CONF-801030—Vol.3, pp 987-990) **Preliminary studies on utilization of soybean milling residue for the production of alcohol.** Srivastava, K.C.; Popper, I.O.; Wosiachi, G. (Universidade Estadual de Londrina, Parana, Brazil). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Screening of the alcohol production from soybean milling residue showed that it could give up to 4% (V/V) of alcohol when the wort prepared from residue was either fermented directly or was pretreated with a strain of Trichoderma viride. Addition of both peptone and yeast extract gave better results. When water extract of the residue was used, production of alcohol was improved to 6% (V/V). Pretreatment of the extract with either T. viride or Cladosporium cladosporioides did not improve the quantity of alcohol produced. Mean generation time showed that the yeast grows better in the extract rather than the extract supplemented with glucose, peptone and yeast extract.

12030 (CONF-801030—Vol.3, pp 991-996) **Demo plant for the production of fermentation ethanol for the motor fuel market in Sweden.** Larsson, E. (Swedish Methanol Development Co., Stockholm). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

The design of a DEMO plant for ethanol is briefly described as a first step in a continuous development of a production capacity of synfuels in Sweden. The plant will feature the BIOSTIL technique, newly developed by Alfa-Laval. Continuous fermentation of concentrated substrates, thereby substantially reducing water flow in the process, is an important characteristic, which helps to limit energy expenditure in ethanol production. Coproduction of animal feed, rich in protein, is important for facility economics and helps at the same time to alleviate an otherwise difficult waste problem.

12031 (CONF-801030—Vol.3, pp 997-1003) **Evaluation of energy expenditures in the agricultural phase of some crops.** Moreira, J.R. (Universidade de Sao Paulo, Brazil); Goldemberg, J.; Serra, G.E. Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

An evaluation of all the energy requirements for sugarcane, cassava, cotton, corn, soybeans, wheat, Eucalyptus, Pinus, tomato and potato crops was performed. The energy computation uses Process Analysis, Input-Output Matrix techniques and/or a combination of both. To achieve realistic results, a field survey was performed including direct interview with farmers; the collected data were converted to energy using the Brazilian and North-American Input-Output Matrix, for products generated in the country or imported, respectively. The results show that the energy requirements for the crops exploited in the area under survey (State of Sao Paulo, Brazil) are lower than the ones used in similar crops in the USA either per ha or per ton. Since the yields in Brazil are lower than in the USA, a correlation between these facts and energy expenditures does exist, but other factors such as climate, soil quality and seeds varieties cannot be neglected in such analysis.

12032 (CONF-801030—Vol.3, pp 1013-1018) **Comparative assessment of the environmental and health effects associated with selected synthetic and alcohol fuel production/conversion technologies.** Salmon, E.J. (National Research Council, Washington, DC); Bentz, E.J. Jr. Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Selected alternate synthetic and alcohol fuel technologies are described. The description includes an identification and assessment of: material, natural resources, and manpower requirements; conversion efficiencies; air emissions; toxic and carcinogenic emittants; ecological disruption; transport and infrastructure requirements; and occupational health factors. The technologies are then placed on an equivalent comparative basis and the resulting comparisons of equivalent factors are discussed. Because much-needed statistical data is not available, relative indices were developed and used to denote comparative effects. Comparative environmental and health effects associated with the alternative production/conversion processes are discussed.

12033 (CONF-801030—Vol.3, pp 1019-1022) **Analysis of five on-farm ethanol units in the United States.** Sklar, S. (National Center of Appropriate Tech., Washington, DC). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

A survey of on-farm ethanol production in the United States using five case studies is provided. These cases have been singled out for several reasons which include length of operation, accuracy of monitoring, ease in obtaining information and contrasts in technology.

12034 (CONF-801030—Vol.3, pp 1023-1032) **Impact of biomass-derived energy programs.** Kuehner, J. (Newton, MA). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Evaluation of biomass-based energy programs at various levels is addressed briefly. Two important characteristics of such programs are taken into consideration: (1) it is only one part of an overall national energy program; and (2) it is made up of various individual (urban and rural) projects that are located across a country and that are characterized by different raw material input, conversion technology, and end use requirements, thus exhibiting very different impacts. The uses of urban solid residuals and (rural) sugarcane for conversion to energy are mentioned as examples of the integration/evaluation of two typical subprograms within sectoral planning efforts (Characteristic 1). Three types of environmental impacts associated with biomass-based energy at the program/project level (Characteristic 2) are discussed: (1) those associated with the agricultural/raw material production phase; (2) those associated with conversion technologies; and (3) those associated with

the utilization phase. The example of sugarcane based alcohol programs is used to indicate this.

12035 (CONF-801030—Vol.3, pp 1033-1040) **Economic feasibility of agricultural alcohol production.** Hertzmark, D.; Flaim, S. Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

The paper is organized according to technical and economic feasibility, product economics, and policy issues. Most important in this latter category are agriculture and energy policies - particularly synthetic fuels policies.

12036 (CONF-801030—Vol.3, pp 1047-1050) **Microwaves and the industrial production of ethanol.** Senise, J.T.; Concone, B.R.V.; Moraes, V.L.V.; Doin, P.A.; Medugno, C.C.; Andrade, A.O.M.; Perri, E.B.; Perin, A.H. (Instituto Maua de Tecnologia, Sao Caetano do Sul, Brazil). Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Production of ethanol from starchy materials is now being investigated in Brazil as an alternative source for alcohol production apart from sugar cane. In the present work, with the objective of optimizing the energy balance of the process, substitution of conventional sources of energy by electricity at one stage of the process is sought. Cooking and dextrinization of cassava roots, previously treated by conventional pretreatments, by microwaves heating (at 2450 MHz) has been studied. Results of saccharification and fermentation of the mash thus obtained were used to evaluate the technical feasibility of the process. Specific energy consumption figures (for the cooking and dextrinization stage) of 600 kcal/l of ethanol produced and efficiencies of 90% (in terms of the theoretical maximum yield from the available starch) were easily and consistently obtained.

12037 (CONF-801030—Vol.3, pp 1051-1054) **Microbiological control of ethanol fermentation in industrial scale.** Serra, C.E. (Universidade Estadual Paulista, Brazil); Cereda, M.P.; Pinho, S.Z.; Meneguim, M.A.; Marino, E.A.; Ferreira, L.J.; Bethiol, A.E. Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Microbiological control of ethanol fermentation at industrial level, including studies of yeast mineral nutrition, bacterial contamination, biocides utilization and recovery and treatment of yeast, is under investigation. The first results concerned with microbiological control are presented. For a complete understanding of the results it is necessary to emphasize that they were collected in a commercial distillery of 800,000 liter of ethanol per day production capacity. Since the data were obtained during only one season, the major goal of this communication is to present the results showing the necessity of more research and the possibilities of achieving better operation technical parameters.

12038 (CONF-801030—Vol.3, pp 1055-1059) **Analysis of possible yield improvement in the industrial processing of sugarcane to alcohol.** Doin, P.A.; Neto, A.O.B.; Pinto, A.G.; Concone, B.R.V. (Instituto Maua de Tecnologia, Sao Caetano do Sul, Brazil). Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

This work analyzes the current average values of the most representative parameters of the process of ethanol production from sugarcane and compares them to projected values that would be attained at medium and long term through technological improvements. The consensus about the values of the parameters adopted for the analysis was obtained. It was found possible to get a remarkable increase of the final yields of the process (in liters of alcohol per ton of sugarcane). A brief analysis of the Brazilian research and development programs related to ethanol production was made.

12039 (CONF-801030—Vol.3, pp 1061-1066) **Microplants for ethyl alcohol production.** Villen, R.A. (Instituto de Pesquisas Tecnologicas do Estado de Sao Paulo, Brazil). Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

This report deals with the Design of Microplants for Ethyl Alcohol Production, as a part of the Energy for Rural Development concept suggested and supported by the Sao Paulo State Government, aimed at finding a new solution for the problem of energy independence for small rural enterprises and communities remote from the country's more developed centers. In order to arrive at a realistic concept for these Microplants with regard to their technical and economic feasibility and especially to their initial cost, original solutions were developed for several items of equipment necessary to the process. Specially notable among these are a wooden fractionating column packed with bamboo Raschig rings and a steel - reinforced cement-mortar tank for storing the final product.

12040 (CONF-801030—Vol.3, pp 1067-1073) **Use vegetable oils in internal combustion engines.** de Oliveira, S. Jr. (PROMEC Projetos Mecanicos S/C Ltd., Brazil); de Mattos Silvares, O.; Brinati, H. Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

An analysis of some aspects related to the use of vegetable oils in internal combustion engines is presented. Initially, based on the examination of physical and chemical properties of such oils, it is shown the feasibility of their application in compression-ignition engines (Diesel engines). Equivalent chemical formulas are derived for such oils; they allow the evaluation of the stoichiometric fuel-air ratios. Estimates of the variation of the engine power and fuel consumption were based upon the fuel-air ratios and heat values of these oils, when Diesel oil is replaced. The examination of the physical properties of these oils also allows to predict the problems of engine operation and the required modifications to be performed in the engine. Test results obtained both from laboratory and vehicle experiments carried out with Diesel engines fueled with vegetable oils are analysed and the main conclusions are pointed out. Sone comments about the use of Diesel oil - vegetable oil blends are also presented. Finally, a comparison is made of the various vegetable oils, taking into account the fuel performance in the engine.

12041 (CONF-821213—2) **Technical considerations in choosing alcohol fuels for less-developed countries.** Googin, J.M.; Compere, A.L.; Griffith, W.L. (Oak Ridge Y-12 Plant, TN (USA); Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 16p. NTIS, PC A02/MF A01. Order Number DE83004644.

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

Current US and Latin American interest has focused on replacement and substitution of gasoline by ethyl alcohol. However, extending diesel fuel, which is used in agricultural engines and necessary transport, is the basic concern. Three attractive methods, involving the use of vegetable or tree oils, alcohols, in some cases with water, can be successfully used to extend or replace diesel fuels: (1) fatty acid - alcohol - water microemulsions in diesel fuel, (2) higher-alcohol esters of fatty acids, and (3) direct diesel fuel extension with higher alcohols. All three methods of extending diesel fuel are amenable to an appropriate-technology situation.

12042 (DOE/ER/10879—2) **Fermentation to ethanol of xylose present in biomass byproduct solution. Progress report, April 1-December 31, 1982.** (Washington Univ., Seattle (USA). Dept. of Genetics). 1982. Contract AT06-81ER10879. 8p. NTIS, PC A02/MF A01. Order Number DE83004900.

The emphasis of this project was directed toward the isolation of the xylose isomerase gene from E. coli and subsequent expression of the gene in yeast. DNA from the E. coli xylose gene cluster was cloned by complementation of an E. coli xylose negative mutant. The E. coli xylose isomerase protein was isolated and partly sequenced, as was the putative xylose isomerase gene. Comparison of the two sequences indicated that the gene cloned did indeed encode xylose isomerase and located, in the DNA sequence, the position at which the coding sequence starts. Based on that information, in vitro deletion of extraneous 5'-linked sequences were

carried out to place the translation start for xylose isomerase immediately next to the promoter sequences from S. cerevisiae ADHI and S. pombe ADH.

12043 **(DOE/ER/10939—2) Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982.** Bhattacharya, P.K. (Oregon State Univ., Corvallis (USA). Dept. of Electrical and Computer Engineering). 1982. Contract AT06-81ER10939. 52p. NTIS (US Sales Only). Order Number DE83004899.

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Several fundamental properties in the organometallic vapor phase epitaxial (OMVPE) Al/sub x/Ga/sub 1-x/As alloys have been revealed and interpreted. Dominant electron traps in these alloys have been identified for the first time. A consistent behavior of the deep traps in these materials, where the trap activation energy and capture cross-section show definite trends, have been explained by the lattice relaxation model. The results also throw light on the physico-chemical origin on the origin of a deep trap labeled EL2 in these materials. Low-field mobilities in the alloys have been measured as a function of temperature in alloys with $0 \leqq x \leqq 0.8$. For $x \leqq 0.3$ the mobility values can be interpreted by the known scattering theories. Abnormally high mobilities in alloys with $x \leqq 0.35$ are being observed for the first time and have been interpreted by considering the modulation doping process. This effect has important effects on the performance of cascade solar cell. Photoluminescence data indicate the presence of C, Si, Ge and Cu as the major impurities in OMVPE Al/sub x/Ga/sub 1-x/As.

12044 **(DOE/ET/23197—T9) Semicrystalline casting process development and verification. Quarterly progress report No. 7, December 19, 1981-March 19, 1982.** (Semix, Inc., Gaithersburg, MD (USA)). 1982. Contract FC01-80ET23197. 35p. NTIS, PC A03/MF A01. Order Number DE83004194.

In the seventh quarter, attention turned from demonstration of solidification in ubiquitous crystallization process (UCP) to the mechanisms which affect material performance. Etching and x-ray techniques are being used to reveal the defect structure in semicrystalline material. It has been found using Laue back reflection techniques and Lang x-ray topography that subgrain rotations are associatd with regions of high dislocation density. A thermal model is being constructed to show the mechanism by which these dislocations are generated. Design of the Prototype 3 UCP system was finalized during the quarter and parts were ordered. Investigation of the High Speed MBS was terminated due to mechanical problems, high labor costs and high consumable costs. High instantaneous cutting rates were achieved, but an inordinate amount of downtime made the average output rate lower than expected. Initial demonstrations were made with the 27 inch ID saw. Cutting rates were shown to be proportional to blade speed, but the blade life was disappointing. A second generation high efficiency grid pattern was introduced, increasing the grid lines to 25 μm from 10 μm. This improved the integrity of the front metallization and allowed for a wider grid separation. Grid power losses for this mask are identical to the original mask.

12045 **(DOE/EV/10450—T1) Alcohols from biomass: state-of-knowledge survey of environmental, health and safety aspects.** (Mueller Associates, Inc., Baltimore, MD (USA)). Oct 1981. Contract AC01-81EV10450. 132p. NTIS, PC A07/MF A01. Order Number DE83005069.

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The current status of the environmental information associated with alcohol-fuels production from biomass is described. The environmental aspects of biomass growth and collection, and its subsequent conversion to ethanol and methanol are discussed. What is known and what is not known are emphasized. The topics of product/by-product distribution, health and safety implications, control cost considerations, and associated environmental legislation also are reviewed.

12046 **(DOE/EV/10450—T2) Photovoltaics: state-of-knowledge survey of environmental, health and safety aspects.** (Mueller Associates, Inc., Baltimore, MD (USA); Jet Propulsion Lab., Pasadena, CA (USA)). Jun 1982. Contract AC01-81EV10450. 103p. NTIS, PC A06/MF A01. Order Number DE83005068.

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The environmental, health and safety issues are addressed that have been identified for various photovoltaic technologies/materials, and the results of recent research into specific areas of concern are summarized. A distinction is made between those concerns common to all PV technologies and those specific to a single technology or application. The photovoltaic-energy-system life cycle is conveniently described in terms of four stages: raw-material collection and refining; component manufacture; system installation and operation; and decommissioning and disposal. Research to date has addressed selected issues in each stage of the system life cycle. These include the acquisition and/or application of toxic materials required in certain cell technologies, specific manufacturing processes or process scales, and the environmental effects of large, centralized systems.

12047 **(DOE/EV/10450—T3) Biomass energy systems: status of environmental, health and safety investigations.** (Mueller Associates, Inc., Baltimore, MD (USA)). May 1982. Contract AC01-81EV10450. 64p. NTIS, PC A04/MF A01. Order Number DE83005067.

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A synthesis of information and environmental data relevant to biomass energy is presented, covering the following: biomass resources and conversion processes. The environmental impacts from biomass resources are discussed as follows: land impact, water impact, wetlands impacts, control technology, and occupational health and safety. (MHR)

12048 **(DOE/ID/12274—T1-Vol.6) Technical/commercial feasibility study of the production of fuel-grade ethanol from corn: 100-million gallon-per-year production facility in Myrtle Grove, Louisiana.** (Singmaster and Breyer, New York (USA)). 31 May 1982. Contract FG07-81ID12274. 465p. NTIS, PC A20/MF A01. Order Number DE83000772.

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The following appendices are included: specifications and design criteria, equipment list, motor list, companies contacted for marketing, and schedules.

12049 **(DOE/JPL—956205-82/2) Development of metallization process, FSA project, cell and module formation research area. Quarterly technical report for the period ending September 30, 1982.** Garcia, A. III. (Spectrolab, Inc., Sylmar, CA (USA)). Nov 1982. Contract NAS-7-100-956205. 14p. NTIS, PC A02/MF A01. Order Number DE83004844.

Solar cells without AR coating achieved efficiencies of 10.5% with the Type A Mo/Sn/TiH paste. Curve shape, series resistance, and shunt resistance are all excellent and comparabe to silver paste controls. Other pastes were not successful.

12050 **(DOE/JPL/955909—82/8) Low-cost solar-array project: cell and module formation research area. Process research of non-CZ silicon material. Quarterly report No. 3, September 1, November 30, 1982.** (Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). 1982. Contract NAS-7-100-955909. 37p. NTIS, PC A03/MF A01. Order Number DE83005088.

Extensive extended experiments allowed direct comparisons of the baseline diffusion masking and drive processes with those involving direct liquid applications to the dendritic web silicon strips. In these experiments, attempts were made to control the number of variables by subjecting dendritic web strips cut from a single web crystal to both types of operations. Data generated have reinforced earlier conclusions that efficiency levels at least as high as those achieved with the baseline back junction formation process can be achieved using liquid diffusion masks and liquid dopants. The most

recent experiments conducted on this task using liquid boron and SiO_2 solutions, have produced results indicating that cell efficiencies may be enhanced with this low cost process. Cell efficiencies as high as 17% were recorded in the first batch of cells processed with liquids received from this vendor. The average cell efficiency of this batch, 14%, was a full percent higher than average cell efficiencies obtained with the baseline process sequence. Tests were conducted which established the feasibility of substituting a belt furnace for the standard tube type furnaces previously used to drive junctions formed using liquid dopants into dendritic web silicon. Preparation of dendritic web material for use in ion implantation work was initiated this quarter. In addition, the deliveries of dendritic web sheet material and solar cells specified by the current contract were made as scheduled. Installation of the Kayex-Hamco silicon pellet shot tower which was transferred to this contract was completed. Shakedown tests were completed, and several operational runs have been made.

12051 **(DOE/RA/50317—T1) Feasibility study for alternative-fuels production: fluidized-bed gasification of wood waste. Biomass Alternative-Fuels Program: final report.** (Synergy Systems Management Corp., Boca Raton, FL (USA)). Oct 1981. Contract FG07-80RA50317. 158p. NTIS, PC A08/MF A01. Order Number DE83004713.

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This study examines the feasibility of constructing an alternative fuel production facility using wood waste fuel at a steam generation plant owned by the Youngstown Thermal Corporation. The project plan calls for Youngstown Thermal Corporation to own and operate the equipment, which will consist of a fluidized-bed gasification unit. Approximately 100,000 tons per year of wood waste are to be gasified in order to produce a low-Btu gas that will be burned in retrofitted boilers, replacing No. 2 fuel oil. The product steam is to be distributed to the central business district of Youngstown. The project team found that fluidized-bed gasification of wood waste had a great potential to reduce fuel oil demand of the Youngstown Thermal Corporation. The low-Btu gasification process has a potentially broad application in view of rising fossil-fuel costs, stringent environmental controls, and the widespread availability of biomass fuels. A by-product of gasification, char, is also marketable as a fuel. Despite many favorable aspects of the project, it was concluded that the poor rate of return for the plant when it was compared to coal conversion eliminated the viability of the project.

12052 **(DOE/RA/50320—T1) Feasibility study of the production and use of wood-derived fuels in a large chemical plant. Final report.** (American Cyanamid Co., Savannah, GA. Chemical Products Div.; Georgia Inst. of Tech., Atlanta (USA). Engineering Experiment Station; F and W Forestry Services, Inc., Savannah, GA (USA)). Aug 1981. Contract FG07-80RA50320. 313p. NTIS, PC A14/MF A01. Order Number DE83004714.

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This feasibility study encompassed the following issues, concerns, and assessments: present energy use, plant physical constraints, available systems, fuel quality, wood supply, conceptual design, future planning, uncertainty analysis, economic analysis, environmental assessment, socioeconomic effects, and safety and health. (MHR)

12053 **(DOE/RA/50328—T1) Feasibility study for a 1-MM-gal/y fuel-grade ethanol facility.** (Rochelle Energy Development, IL (USA)). Oct 1981. Contract FG07-80RA50328. 83p. NTIS, PC A05/MF A01. Order Number DE83004394.

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The feasibility of constructing a one million gallon-per-year fuel-grade ethanol plant was determined. Plant design, including process design and instrumentation, is based on a previously constructed and operated plant and was not part of this study. Site location, with suitable sources for natural gas, feedstocks, and by-product markets was finalized. The environmental concerns associated with the project, plant size, and plant location were determined as minimal and the required permits were identified. Economic analysis indicated the project to be economically infeasible at this time; thus, ethanol marketing and financing has not been further pursued.

12054 **(DOE/RA/50338—1-Vol.1) Report on the engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc., at Thibodaux, Louisiana.** (Tate and Lyle Technical Services Ltd., Coral Gables, FL (USA); Independence Energy Co., Inc., New York (USA)). Apr 1982. Contract FG07-81RA50338. 174p. NTIS, PC A08/MF A01. Order Number DE83001199.

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The findings of an engineering and economic feasibility study for a 20 million gallon per year capacity anhydrous ethanol distillery project are presented. The distillery is to be located at a Louisiana sugar factory. A complete summary description of the project is given, together with complete analysis of financial performance. The distillery will accept a range of feedstocks: sugarcane, corn, molasses, and sweet sorghum. Energy for the process will be provided by bagasse from the sugarcane, supplemented by lignite. Findings of a study to assess the availability and costs of the feedstocks are summarized. Ethanol and byproduct yields are analyzed. The market for gasohol and ethanol is analyzed, followed by costs and revenues and a financial analysis. Main findings on socioeconomic impacts and environmental impacts are summarized. (LEW)

12055 **(DOE/RA/50353—T1-Vol.2) Feasibility study for alternative-fuels production in Lincoln, Nebraska.** (Nebraska Alcohol Fuels Corp., Lincoln (USA)). 30 Nov 1981. Contract FG07-80RA50353. 488p. NTIS, PC A21. Order Number DE83003737.

PC only, illegibility does not permit Mf reproduction.

Descriptions of 50- and 15-million gallon plants are presented. A Definitive Design and Cost Estimate was not completed for the 50-million gallon size because loan guarantees were rescinded and the feasibility study scope changed. The description of the 15-million gallon plant was developed by scale-down of the larger plant and was used to examine the economics of a smaller-sized plant. Cost details are presented for the 50- and 15-million gallon per year plants described. (MHR)

12056 **(DOE/SF/11429—1) Heber Known Geothermal Resources Area ethanol-fuel facility. Final technical report.** (VTN Consolidated, Inc., Irvine, CA (USA)). Sep 1982. Contract FG03-80SF11429. 300p. NTIS, PC A14/MF A01. Order Number DE83004775.

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This feasibility study covers geothermal resource evaluation, process engineering, facilities engineering, marketing, economics and finance, and environmental analysis. (MHK)

12057 **(DOE/SF/11525—T2) High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982.** Remick, R.J.; Carty, R.H.; Schreiber, J.D. (Institute of Gas Technology, Chicago, IL (USA)). Dec 1982. Contract AC03-81SF11525. 68p. NTIS, PC A04/MF A01. Order Number DE83002537.

The objective of this program was to continue developmental research on three promising chemical processes for producing hydrogen from water using a solar thermal energy source. The effort consisted of parametric laboratory studies of various process steps and a conceptual design of a solar reactor/receiver suitable for use with a solid reactant. The thermal decomposition of copper (II) oxide to copper (I) oxide and oxygen was studied at temperatures from 800° to 950°C using steam as a carrier gas. The reaction followed a shrinking-sphere model rate law. The thermal decomposition of anhydrous copper sulfate was studied using nitrogen and sulfur dioxide as carrier gases. Similarly, the thermal decomposition of zinc sulfate was studied under both nitrogen and sulfur dioxide carrier gases. The precipitation of zinc sulfate from aqueous solution by taking advantage of its retrograde solubility was studied at 250°C and 700 psi. Experimental results confirmed that the addition of certain homogeneous catalysts, such as hydrogen iodide, to the solution neither interfered with the sulfate precipitation nor were themselves precipitated. Several conceptual designs of solar reactor/receivers were evaluated specifically for use in decomposing

solid metal sulfates. Five designs were selected as likely candidates for further experimental work: (1) a rotary kiln, (2) a fluidized bed, (3) an air slide, (4) a rotating drum, and (5) a pebble bed reactor. The air slide was chosen as the most promising.

12058 **(EUR—8148-EN) Competitive investigations of oxidation processes for silicon MIS-solar cells. Final report.** Kippermann, A.H.M. (Technische Hogeschool Eindhoven (Netherlands)). 1982. 34p. European Community Information Service, 2100 M Street, NW, Suite 707, Washington, DC.

The purpose of this project is to study in a systematic manner several oxidation processes as applied for MIS-solar cells on silicon. This has been done by using the same base material for all samples and test the result of the treatments in a MIS-cell with a moderate barrier height, so all the interface effects are visible. Further it was most important that the interface has not been altered by any chemical interaction between the metal contact and the oxide layer; for this reason sputtered gold has been applied in all cases. Special attention has been given to a reproducible very thin initial layer on the sample prior to any treatment; this is reached by a careful cleaning followed by a dip in a HF-solution of 40%. The probability of a chemical reaction of several contact metals, Hf, Ta, Al, Ti, and Cr in particular, on silicon oxide has been determined by comparing the heats of formation of the metal oxide with that of silicon. The following treatments have been applied: heating in vacuum and in oxygen; rinsing in water; $HClO_4$ + HCl; Aqua regia; anodic oxidation in HCl, exchange reaction and for comparison with MOS-device technology and H_2-treatment at 450°C. The difference in properties of MIS-cells made on all these different oxide layers has been checked by I-V-measurements in dark and under illumination. Additional to the electrical measurement, SIMS-AES analyses have been carried out on a few samples and resulted in a strong confirmation of a residual layer, after the HF-dip with an average composition of $SiOF_2$ and a thickness of about 7 A even some Si-F bonds have been found up to the very interface.

12059 **(EUR—8150-EN) Development and installation of a 2-kW photovoltaic array at Poynton, nr Manchester. Final report.** Whale, A.V. (Ferranti Ltd., Oldham (UK)). 1982. 31p. European Community Information Service, 2100 M Street NW, Suite 707, Washington, DC 20037.

The development of a 2-kW photovoltaic array suitable for use in a N. European location is reported. The chosen module design was the Ferranti MST.300 15-watt solar-power module. The 2-kW array comprised 144 basic modules connected to charge a 108-volt, 1150-ampere-hour battery system. A microprocessor-controlled monitoring system has been constructed so that the performance of the array could be monitored automatically at fixed intervals. In operation, it was found that the standard MST.300 module was not sufficiently rugged for application in this high-voltage array. A significant number of the 144 modules suffered electrical breakdown of their insulation to their metal baseplate. However, a relatively simple change to the standards MST.300 module design has been shown to overcome this failure mechanism.

12060 **(EUR—8208-EN) Process of deposition of silicon single-crystal bars directly from the vapour phase.** Giarda, L.; Pizzini, S.; Pizzini, V. (Montedison S.p.A., Novara (Italy). Ist. di Ricerche G. Donegani). 1982. 17p. European Community Information Service, 2100 M Street, NW, Suite 707, Washington, DC.

An investigation has been carried out in order to understand the origin of macrodefects in silicon monocrystals and avoid their formation in chemical vapor deposition as well as to evaluate the cost reduction resulting from the use of tetrachlorosilances in the reagent mixture. Results obtained show that macrodefects are due to carbon particles originated by an electric discharge at the graphite holders and deposited on the surface of the seeds. The formation of the macrodefects could be strongly reduced if seeds are heated in air atmosphere. As for the tetrachlorosilane use it has been found that the deposition rate is reduced, when tetrachlorosilane is present in the reagent mixture and, therefore, that only limited cost savings are obtained.

12061 **(IS-T—1020) Adsorption of ethanol and water vapor by Silicalite, a hydrophobic molecular sieve.** Klein, S.M. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 69p. NTIS, PC A04/MF A01. Order Number DE83004981.

Thesis.

The molecular sieve Silicalite, which is known to selectively adsorb organic molecules from aqueous solutions, was studied to determine its capacity to adsorb mixtures of ethanol and water vapor. Measurements were made of the weight adsorbed from these vapors at isothermal, equilibrium conditions and at different pressures and temperatures. The work shows that the mass of vapor adsorbed is only dependent on the partial pressure of ethanol in the ethanol/water vapor, provided that the vapor is at least 27 mole % ethanol. The heat of adsorption of ethanol on this adsorbent was estimated to be about 17 kcal/(gmol ethanol), based on two different types of experiments, whereas water has a heat of adsorption of only 6 kcal/(gmol water), as reported by Flanigen et al. This suggests that Silicalite would be very selective for ethanol over water. Using a Langmuir model, a selectivity factor y/sub w//x/sub w// y/sub e//x/sub e/ of about 13 was estimated at 60°C, where y/sub i/ and x/sub i/ represent the mole fractions of water and ethanol in the vapor and adsorbed phases for this system. Adsorption of ethanol/water mixtures by a small sample of Silicalite was noticeably greater than adsorption by a larger bed of the same material, indicating that equilibrium in a larger bed is difficult to achieve because of resistance to mass transfer in the adsorbent micropores when water is initially adsorbed.

12062 **(IS-T—1045) Electrical properties of WSe_2, WS_2, $MoSe_2$, MoS_2, and their use as photoanodes in a semiconductor/liquid junction solar cell.** Kam, K.K. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 125p. NTIS, PC A06/MF A01. Order Number DE83004789.

Thesis.

The electrical resistivity and Hall effect perpendicular to the c-axis of single crystals of n-type WSe_2, $MoSe_2$, WS_2, and MoS_2 were studied in the extrinsic conduction temperature range (77°K to 300°K). It was found that a single-donor energy level can be assigned to the crystals of WSe_2 and $MoSe_2$, even for crystals from different growth ampoules. E/sub D/ = (108 +- 4) MeV for WSe_2 and (64 +- 2) MeV for $MoSe_2$. The electron Hall mobility of these two compounds depends strongly on temperature. μ/sub H/ $\sim T^{-2.4}$ for WSe_2 and $\sim T^{-2.6}$ for $MoSe_2$. For WS_2 and MoS_2, the results were not as consistent as those for WSe_2 and $MoSe_2$ because of poorer crystal quality. The resistivity parallel to the c-axis was also studied on single crystals of WSe_2 and $MoSe_2$. The resistivity anisotropy of these two compounds is small, compared to that reported on natural single crystals of MoS_2. Single crystals of n-type WSe_2, $MoSe_2$, WS_2, and MoS_2 were employed as photoanodes in a photoelectrochemical solar cell with a variety of redox couples as the charge-transfer agents. It was found that WSe_2 is the best photoelectrode material of all, and the redox couple, I^-/I_3^-, provides a fast-kinetics path for electron transfer. An efficiency as high as 10.2% was achieved for an n-WSe_2/I^--I_3^-/Pt cell, and 9.4% when $MoSe_2$ was used. The cell (n-WSe_2/I^--I_3^-/C) is stable for at least one year. Polycrystalline samples of n-WSe_2 were also studied as photoanodes in such a cell, but their performance is poor, compared with that of single crystals, because defects, such as steps on the crystal surface and grain boundaries, act as recombination centers. Transmission spectra of single crystals of WSe_2 were studied near the fundamental absorption edge. Based on the experimental results, it was concluded that WSe_2 is an indirect band-gap material.

12063 **(LA-UR—82-3566) Levelized life-cycle costs for four residue-collection systems and four gas-production systems.** Thayer, G.R.; Rood, P.L.; Williamson, K.D. Jr.; Rollett, H. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 20p. (CONF-830114—1). NTIS, PC A02/MF A01. Order Number DE83004735.

From Energy from biomass and wastes symposium; Lake Buena Vista, FL, USA (24 Jan 1983).

Technology characterizations and life-cycle costs were obtained for four residue-collection systems and four gas-production systems. All costs are in constant 1981 dollars. The residue-collec-

tion systems were cornstover collection, wheat-straw collection, soybean-residue collection, and wood chips from forest residue. The life-cycle costs ranged from $19/ton for cornstover collection to $56/ton for wood chips from forest residues. The gas-production systems were low-Btu gas from a farm-size gasifier, solar flash pyrolysis of biomass, methane from seaweed farms, and hydrogen production from bacteria. Life-cycle costs ranged from $3.3/10^6 Btu for solar flash pyrolysis of biomass to $9.6/10^6 Btu for hydrogen from bacteria. Sensitivity studies were also performed for each system. The sensitivity studies indicated that fertilizer replacement costs were the dominate costs for the farm-residue collection, while residue yield was most important for the wood residue. Feedstock costs were most important for the flash pyrolysis. Yields and capital costs are most important for the seaweed farm and the hydrogen from bacteria system.

12064 **(NP—25147) Evaluation of a system utilizing biomass (straw) as fuel for crop drying and heating on the farm.** Peill, J.E. (Peill (J.E.), Canning, Nova Scotia (Canada)). [nd]. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83901086.

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The use of straw as fuel for crop drying, space heating and other heat consuming processes is technically feasible and can be economically viable with today's technology. An economic argument can already be made for utilizing the entire grain plant, straw and grain, from a species such as rye, solely for fuel purposes. It is to be expected that other plant species yet to be identified are likely capable of providing higher fuel values per hectare than our existing species, which were selected for different purposes altogether. Ideally suited would be plant species which do not require annual seeding, but which could still be procured with already existing farm equipment.

12065 **(ORNL—5894) On-farm use of biomass fuels: market penetration potential during normal and fuel-emergency conditions.** Bjornstad, D.J.; Hillsman, E.L.; Tepel, R.C.; Mills, J.B.; CHester, C.V.; Klepper, O.H.; Borkowski, R.J.; Nichols, J.; Rainey, J.A. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 190p. NTIS, PC A09/MF A01. Order Number DE83005180.

The potential for biomass fuels produced in decentralized facilities to replace the centrally produced fuels currently used in agriculture is examined. Two issues are examined. Will biomass fuels become cost-competitive relative to central fuels. And, what is the potential for biomass fuels to replace central fuels during emergency conditions when central fuels are unavailable. To answer these questions, descriptions of a range of currently available biomass technologies have been prepared and estimates made of current and projected agricultural fuel needs and biomass-feedstock availabilities. A variety of assumptions about future conditions have been adopted, the most important of which is that central fuel prices escalate at 7.5% annually relative to the commodities and inputs used to produce biomass fuel products. Under these assumptions, a number of biomass fuels will become cost-competitive during the 1980s, but most will do so late in the decade. Moreover, once these fuels become cost-competitive, penetration will occur gradually. Market forces thus will not markedly reduce the vulnerability of agriculture to energy-supply interruptions during this period. Biomass fuels could, however, play an important role during a fuel emergency. Estimates indicate they could replace up to about 60% of annual agricultural-sector fuel consumption by 1990, during the course of a fuel emergency of one year's duration.

12066 **(ORNL/TM—8120) Short-Rotation Woody-Crops Program. Annual progress report for 1981.** Ranney, J.W.; Cushman, J.H. (Oak Ridge National Lab., TN (USA)). Jul 1982. Contract W-7405-ENG-26. 65p. NTIS, PC A04/MF A01. Order Number DE83005002.

This report is a summary of work sponsored by the US Department of Energy in the Short Rotation Woody Crops Program. The program is concerned with new wood production techniques that attain high productivity levels. Sometimes known as short rotation intensive culture, experimentation concentrated on hardwood tree species that stump sprout and can be re-harvested every 3 to 10 years. Research focused on the screening of fastgrowing species and techniques of short-rotation wood crop management, although plant propagation, new wood recovery systems, and economic evaluations are within the scope of the program. The program's objective is to attain high productivity rates at competitive prices.

12067 **(PNL-SA—7939-Rev.3) Investigation of gasification of biomass in the presence of catalysts.** Mudge, L.K.; Robertus, R.J.; Sealock, L.J. Jr.; Mitchell, D.H.; Weber, S.L. (Pacific Northwest Lab., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 32p. (CONF-800973—5-Rev.3). NTIS, PC A03/MF A01. Order Number DE83002736.

From 11. biomass thermochemical conversion contractors meeting; Richland, WA, USA (23 Sep 1980).

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The overall objectives of the studies reported are to determine the technical feasibility of catalytic processes for gasification of wood to specific products and to evaluate the economic feasibility of technically feasible processes. Specific products that are being studied include methane; synthesis gases for production of ammonia, methanol, and hydrocarbons; hydrogen; and carbon monoxide. Preliminary results are reported in work to assist in engineering and economic evaluation of plants to produce methanol and substitute pipeline gas from wood via catalytic steam gasification. Laboratory studies have addressed evaluation of catalyst life, catalyst regeneration and catalyst recycle for processes to generate methanol synthesis gas and methane from wood. An apparatus for determination of nickel surface area was assembled and operated to measure loss in catalyst activity. Several catalysts were tested that showed excellent resistance to poisoning by carbon deposition. Regeneration schemes were developed for catalysts used to generate a methane-rich gas. The process development unit was modified to operate as a fluid bed of catalyst. Catalyst physical requirements for fluidization with wood were defined. Operations for generation of a methane-rich gas were successfully completed at 500°C. Operating temperatures have been limited to 500°C. Installation of in-bed heaters should allow operation of the PDU gasifier at temperatures over 700°C as needed for synthesis gas generation. The feasibility studies are designed to evaluate the economic attractiveness and the commercial applicability of the technically feasible processes. Plant size under study is 2000 tons of dry wood per day. Status of the engineering evaluation and process simulation studies is presented. (LEW)

12068 **(PNL-SA—10646) Proceedings of the 14th biomass thermochemical conversion contractor's meeting.** (Pacific Northwest Lab., Richland, WA (USA)). Aug 1982. Contract AC06-76RL01830. 693p. (CONF-820685—). NTIS, PC A99/MF A01. Order Number DE83002004.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

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Twenty papers are included. Three were abstracted previously for EDB. Separate abstracts were prepared for seventeen. (MHR)

12069 (PNL-SA—10646, pp 1-8) **Application of SGFM technology to alternate feedstocks: Phase III.** Beck, S.R.; Bartsch, R.A.; Yu, J.F.; Wang, R.C. (Texas Tech Univ., Lubbock). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

The process variable study for steam-oxygen gasification of oak sawdust in the SGFM process development unit has been completed. Empirical correlations have been derived for product gas yield, H_2-CO mole ratio and carbon conversion as a function of gasifier temperature, oxygen-to-wood ratio, steam-to-wood ratio and mean solid residence time in the gasifier. These correlations indicate that a synthesis gas with a 2:1 mole ratio of H_2-CO can be produced at a temperature of 950 to 1000°C, an oxygen feed rate of 0.34 kg O_2/kg DAF wood and a steam feed rate of 0.90 kg H_2O/kg DAF wood. An attempt was made to verify these results during extended runs. These runs were not completed due to mechanical problems. All other contract objectives have been completed.

12070 (PNL-SA—10646, pp 32-45) **Steam gasification of biomass.** Coffman, J.A. (Wright-Malta Corp., Ballston Spa, NY). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

The W-M Steam Gasification of Biomass Project with DOE is now in the latter part of its third phase. In the third phase, a six green ton/day horizontal auger kiln PDU was designed, constructed, and operated. It confirmed the bench-scale chemistry and completeness of gasification, but was less than satisfactory in heat transfer and transport characteristics. The present work is pointed toward revamping the PDU, with replacement of the auger by a curved vane rotor for better tumbling and heat transfer. The kiln barrel will be tilted about 5° to provide transport by gravity as in a rotary kiln. Design work is essentially complete; cold modeling in a full diameter tilted plastic barrel showed very satisfactory tumbling and transport. A mini-rotor kiln (16″ diameter) was built; several runs in it to various temperatures showed no indication of wood chip agglomeration or sticking to rotor blades and walls during the pyrolysis period. Actual revamping of the PDU awaits funding.

12071 (PNL-SA—10646, pp 46-70) **Gasification of forest residues in a high-throughput gasifier.** Feldmann, H.F.; Paisley, M.A.; Appelbaum, H.R. (Battelle Columbus Labs., OH). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

A high throughput gasification system is being developed for the gasification of wood residues and other biomass. Thus far experiments in a PDU having a nominal capacity of 300 lbs/hr (dry wood chips) have demonstrated the ability of producing 500 Btu/SCF hydrocarbon-rich fuel gas using circulating sand as a heat source for gasification. Economic analyses indicate that this system, if commercialized, could produce fuel gas at prices more than competitive with fuel oil or new natural gas even in relatively small (100 tpd dry) installations.

12072 (PNL-SA—10646, pp 71-149) **Development of biomass gasification to produce substitute fuels.** Kosowski, G.M.; Rose, G.R.; Nandi, S.P.; Onischak, M.; Zabransky, R.F.; Babu, S.P. (Inst. of Gas Technology, Chicago, IL). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

The development at the Institute of Gas Technology (IGT) of a pressurized steam-oxygen fluidized-bed biomass gasification process included support task work on biomass characterization, fluidization, bench-scale devolatilization and char gasification, and the design of the process development unit (PDU). During the last 9 months (October 1981 through June 1982), the major emphasis has been on the engineering specification and procurement of the PDU system. The support task work has been completed. Under the characterization task, the physical and chemical properties were determined for a sample of a densified corn stover and compared with those of an undensified sample. Fluidization tests of mixtures of char and inert sand were conducted at an elevated pressure and at ambient temperature to simulate the increased density of the fluidizing gas under the process conditions of 1500°F and 300 psig. An improvement in fluidization behavior over that in the atmospheric pressure fluidization tests was observed. The bench-scale experiments investigated the effect of temperature and residence time on devolatilization of maple hardwood. Isothermal gasification rates of in-situ chars of maple, jack pine, and corn stover were measured. A method was devised to measure the gasification rates of chars that are formed in situ in the thermobalance and undergo immediate gasification. Higher reactivities were measured for these chars than for laboratoty-prepared and stabilized chars.

12073 (PNL-SA—10646, pp 150-201) **System design for wood gasification using internal heating.** Flanigan, V.J.; Findley, M.E.; Sineath, H.H. (University of Missouri, Rolla). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

Removal of air from the process of gasification seems to be the first step toward the production of medium Btu gas. While this enhances the energy content by reducing the nitrogen dilution it makes necessary an alternate means for the provision of the energy of reaction, bed fluidization, char consumption and supply of oxygen. A variety of means are available to adequately counter these problems. Specifically, this paper deals with three viable alternatives to supply the required energy. All of them involve the transfer of heat through fire tubes to the bed of the reactor. The first configuration has horizontal tubes criss crossing the bed, the second has vertical U-tubes; both of which use convection as the primary means of heat transfer of energy through radiation. The workability of these designs is demonstrated and the necessary calculations are appended.

12074 (PNL-SA—10646, pp 230-249) **Technical and economic assessment of liquid-fuel production from biomass.** Wan, E.I.; Price, J.D. (Science Applications, Inc., McLean, VA). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

The technical and economic results of a comprehensive evaluation of five advanced biomass gasification processes for methanol production are summarized. The specific gasification processes evaluated include the PNL, Wright-Malta, Texas Tech, Battelle Columbus, and SERI processes. For these gasification processes selected, twenty alternative integrated conceptual biomass-to-methanol processes were developed. A process flow sheet simulator was utilized to establish process material and energy balance data for 500 TPD grass root methanol plants. The capital costs and the O and M costs were estimated for each plant configuration. Methanol production costs were also estimated for both private and utility financing.

12075 (PNL-SA—10646, pp 250-271) **Entrained flow pyrolysis of biomass.** Knight, J.A.; Gorton, C.W.; Kovac, R.J.; Elston, L.W. (Georgia Inst. of Tech., Atlanta). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

A discussion of research is presented which concerns determining the conditions for maximum oil yield in the entrained flow pyrolysis of hardwoods. The background associated with the research, including the availability of feedstock, the utilization of pyrolytic oil, and the oil yield as a function of the mode of pyrolysis is presented. Also, a brief description of the process and a summary of projected economic results are given. The nominal operating conditions of the experimental PDU will be a feed rate of 1.5 dry tons per day with an operating temperature range of 550 to 750°C. The status of the construction of the PDU is presented. Also, a description of the equipment to be used in the experimental system is given. Sampling and chemical analyses are also discussed. A brief description of the instrumentation and controls to be used is also given.

12076 (PNL-SA—10646, pp 312-402) **Fundamental pyrolysis studies.** Milne, T.A.; Soltys, M.N. (Solar Energy Research Inst., Golden, CO). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

Under conditions optimized for the observation of primary pyrolysis products of biomass and its constituents, the mass spectra of a number of materials are shown when subjected to 900°C steam/argon. The time dependence of species evolution is shown and discussed as is the ionizing electron energy dependence of the major products from cellulose. A quantitative comparison of the primary product slate from celluloses is shown for different sources and physical forms. A comparison with literature values, primarily using analytical pyrolysis techniques involving small samples in vacuum, is discussed. Finally, a new, heated-grid system is outlined.

12077 (PNL-SA—10646, pp 403-451) **Effects of pressure on biomass pyrolysis.** Mok, W.S.; Antal, M.J. Jr. (Princeton Univ., NJ). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

Tubular micro reactors embedded in a differential scanning calorimeter were used to study the effects of pressure and flow rate

on cellulose pyrolysis. The total heat of pyrolysis was found to decrease, and the char yield increase, with increasing pressure and decreasing flow rate. Further experiments were conducted to investigate the secondary reactions of cellulose pyrolysis. Both anhydrocellulose and levoglucosan (immediate products of the primary competitive reactions in cellulose pyrolysis) were found to decompose further by very similar competitive reactions, leading to char and gases by one route, and tar or volatiles by the other. The expanded mechanism of cellulose pyrolysis adequately explains the observed effects of pressure and flow rate.

12078 (PNL-SA—10646, pp 452-471) **Flash pyrolysis of biomass with reactive and non-reactive gases.** Steinberg, M.; Fallon, P. (Brookhaven National Lab., Upton, NY). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

The rapid or flash pyrolysis of wood biomass is being studied in a 1 in. downflow entrained tubular reactor with a capacity of approximately 1 lb/hr of wood. The process chemistry data is being obtained with the view of building a data base and ascertaining the value of producing synthetic fuels and chemical feedstocks by the flash pyrolysis method. Data is being obtained on the effect of non-reactive pyrolyzing gases and the effect of reactive gases, hydrogen for the flash hydropyrolysis of wood and methane for flash methanolysis of wood. Preliminary process design and analysis has been made. The yield of ethylene and benzene is especially attractive for the production of chemical feedstocks from the reaction of methane and wood in a flash methanolysis process.

12079 (PNL-SA—10646, pp 472-486) **Development of wood as an alternative fuel for gas turbine systems.** Hamrick, J.T. (Aerospace Research Corp., Roanoke, VA). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

Research is being carried out by combustion of wood in a 500 horsepower gas turbine. Based upon US Forest Service surveys the wood available in the US can currently supply approximately 79 percent of the nonhydrononnuclear power generated in the contiguous 48 states without disrupting industrial wood supplies for such needs as lumber and pulpwood. The gas turbine is a promising vehicle for dispersed power generation. Using 3000 kw power generating modules, an installation can be started with a single module and expanded with additional modules as development of wood supplies permits. Small systems permit short hauling distances for wood supplies permits. Small systems permit short hauling distances for wood and economical wheeling of power through existing power lines as envisioned by the creators of the Public Utilities Regulatory Power Law. The economical operation of these installations will depend upon the results of the research program now under way to minimize corrosion and erosion of gas turbine buckets and stators by ash from the wood combustion. Cyclone filters, stator and bucket surface coatings, velocity of gases relative to turbine buckets, and effects of high temperature are being evaluated and will continue to be evaluated on the 500 horsepower gas turbine. A major goal of the research is to provide scale up information and achieve economical operation of wood burning gas turbine systems at a capital cost of less than $400 per installed kw.

12080 (PNL-SA—10646, pp 487-545) **Gas turbine demonstration of pyrolysis-derived fuels.** Jasas, G.; Kasper, J. (Teledyne CAE, Toledo, OH). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

A potential non-petroleum base alternate fuel for gas turbines has been identified. This fuel is derived from agricultural and forestry products/wastes through a pyrolysis conversion. Three combustible products are produced - heavy oil, residual char and gas. Blending of the char and oil products yields a two-phase (slurry) fuel with a heating value that is approximately 85 percent (volumetric) of typical petroleum base fuels. The work under this contract is directed to evaluate this pyrolysis-derived fuel slurry in a direct-fired gas turbine application. Analysis of the combustion process was conducted and the indicated hardware designs were procured. Test evaluations were carried out in a gas turbine combustor rig operated at approximately one atmospheric inlet pressure. The pyrolytic fuel properties and characteristics were measured along with its effects on typical materials used in gas turbine engines. Test results indicate that process is technically viable with potential of high combustion efficiency. Additional fuel properties refinement along with combustor and fuel handling modifications will be necessary to bring this technology up to threshold for commercialization.

12081 (PNL-SA—10646, pp 546-568) **Biomass fueled Stirling engine system research and development.** Percival, W. (United Stirling Inc., Alexandria, VA); Gummesson, S.; Hansson, B. Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

Being a closed cycle machine, the Stirling engine has the ability to efficiently burn solid fuels, as well as a wide variety of liquid or gaseous fuels. Work done to investigate direct combustion of wood chips (Phase I) as well as indirect combustion by means of a gasifier, combined with a Stirling engine (Phase II) is reported. Phase I work verified the feasibility of metering and burning 8 mm wood chips in a cyclone combustor, simulating a Stirling engine burner. Work done under Phase II, which is emphasized here, verified that wood chips could be converted into mechanical energy by means of a biomass gasifier Stirling engine system. Automatic control of fuel/air flow and engine heater temperature was found to be feasible. New conversion efficiency is approximately 20 percent and could be increased by improved temperature distribution over the engine working gas heat exchanger. Exhaust emissions were found to be low and could be further reduced by optimization of controls and system components.

12082 (PNL-SA—10646, pp 601-626) **Bench scale research in biomass direct liquefaction.** Elliott, D.C. (Pacific Northwest Lab., Richland, WA). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

The progress of this process research and product analysis effort during the nine months from October 1981 to June 1982 is summarized. A major effort has been the development of a hydrotreating process for product upgrading. Individual components from the product of direct liquefaction of biomass have been subjected to hydrogenation with a number of transition metal oxide catalysts. Sulfided cobalt-molybdenum has been found to be most effective for hydrodeoxygenation of phenolics. Products and potential application to whole oil are described. Analysis of the products from the Biomass Liquefaction Experimental Facility is reported including quantitative gas chromatography-mass spectrometry, oil stability tests and product fractionation by caustic extraction. The bulk of the volatile fraction of the Douglas fir-derived product has been determined to be alkylated phenols, dihydroxybenzenes, naphthols, and guaiacols.

12083 (PNL-SA—10646, pp 627-645) **Examination of alternative catalysts for biomass direct liquefaction.** Rogers, D.Z.; An, T.D. (SRI International, Menlo Park, CA). Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

A broad spectrum survey of water-soluble transition metal salts as potential catalysts for direct biomass liquefaction in a carbon monoxide/steam process has been made. The metals tested were iron, manganese, chromium, ruthenium, rhenium, titanium, vanadium, molybdenum, cobalt, nickel, copper, lead, cesium, niobium, and zinc. Of these metals, cyanide and oxyanion complexes of molybdenum and nickel showed the most potential as catalysts and were selected for further study. The nickel and molybdenum catalysts are fully effective at initial pH's of 6 or higher. In carbon monoxide atmospheres, formate is formed from the metal salts and contributes to the liquefaction by hydride donation. The metal ions also contribute to the liquefaction, acting as hydrogenation catalysts. In hydrogen atmospheres, formate is ineffective as a catalyst, and all observed catalytic activity is due to the metal ion. At an initial pressure of 600 psig of reducing gas, formate catalyzed lique-

factions require at least 70% carbon monoxide for full catalytic effectiveness.

12084 (PNL-SA—10646, pp 646-686) **Feasibility study for early commercialization of a modular-unit dual fluidized-bed system for converting terrestrial biomass into alternate fuels.** Aug 1982. NTIS, PC A99/MF A01.

From 14. biomass thermochemical conversion contractor's meeting; Arlington, VA, USA (23 Jun 1982).

This study investigated the feasibility of commercializing a dual-fluidized bed system for converting biomass as a domestic resource into one of the following alternative fuels: clean gas for direct firing in existing or new boilers designed for natural gas, oil, or coal; methanol; methyl fuel; Fisher-Tropsch liquids; olefins for ethanol or gasoline feedstock; or methane for distribution over long distances. The system proposed is designed to be built on a small scale for industries that have available relatively small amounts (between 100 and 400 oven-dried tons per day) of terrestrial biomass (terrestrial biomass as used in this study means biomass from the land as opposed to aquatic biomass from the water). Wood was selected as the feedstock on which the study was based because of its availability, cost, and near-term potential. The majority of industries that could benefit from utilizing this alternative source of energy already have expensive boilers that are fired by natural gas, oil, or coal. These existing boilers potentially can be retrofitted at a small cost to be operated by the clean gas that is produced from the biomass feed stocks. In addition to investigating the feasibility of using the energy produced by this process as fuel for direct use by industrial boilers, the study examined converting biomass into a variety of liquid fuels that could be stored and transported. The only factors that limit the use of biomass material are that the feedstock not contain over 50% moisture content and that it can be made available in quantities exceeding 100 oven-dried tons per day throughout the year.

12085 (SAND—82-7119) **Advanced concentrator cell-mount analysis. Final report.** Kingston, K. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 191p. NTIS, PC A09/MF A01. Order Number DE83003835.

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Eight advanced photovoltaic concentrator cell-mount configurations for use in the 50 to 200X concentration range have been designed, modeled and tested. Six of these mount types utilize a 1.75-cm-square cell and two use a 7.6-cm-diameter cell. An elastic-plastic computer stress model employing SAP6 was developed for seven of the designs. This stress analysis predicts maximum cell stress and provides information for predicting solder-joint fatigue life. Several empirical methods were attempted to provide support for the analysis. Present solder-joint evaluation techniques were investigated and ranked according to their effectiveness in engineering and production applications. Eighty-two functioning cell mounts of the various configurations were fabricated using both Sn62 and IN#2 solder and exposed to 56 days of accelerated temperature and temperature/humidity cycling. Performance was tested at two-week intervals throughout the cycling. Initial mount performance and the degradation due to environmental cycling is described. Also presented are the design details and costs of the various mount configuations for production quantities of 50 kW and 1 MW per year.

12086 (SAND—82-7128) **Electrical overstress failure in silicon solar cells.** Pease, R.L.; Barnum, J.R.; van Lint, V.A.J.; Vulliet, W.V.; Wrobel, T.F. (Mission Research Corp., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 229p. NTIS, PC A11/MF A01. Order Number DE83004475.

A solar-cell electrical-overstress-failure model and the results of experimental measurements of threshold pulsed failure currents on four types of silicon solar cells are presented. The transient EMP field surrounding a lightning stroke has been identified as a potential threat to a photovoltaic array, yet failure analysis of solar cells in a pulsed environment had not previously been reported. Failure in the low-resistivity concentrator cells at pulse widths between 1 μs and 1 ms occurred initially in the junction. Finger damage in the form of silver melting occurs at currents only slightly greater than that required for junction damage. The result of reverse-bias transient-overstress tests on high-resistivity (10 Ωcm) cells demonstrated that the predominant failure mode was due to edge currents. These flat-plate cells failed at currents of only 4 to 20 A, which is one or two orders of magnitude below the model predictions. It thus appears that high-resistivity flat-plate cells are quite vulnerable to electrical overstress which could be produced by a variety of ...echanisms.

12087 (SAND—82-7134) **PV-cell data-reduction computer program (draft).** Lambarski, T.J. (BDM Corp., Albuquerque, NM (USA)). Nov 1981. Contract AC04-76DP00789. 102p. NTIS, PC A06/MF A01. Order Number DE83004762.

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The details are presented of a computer program to unfold current versus voltage (IV) data from a photovoltaic cell or module. IV data from both forward and reverse bias is used to calculate parameters such as series resistance, saturation current, shunt resistance, and junction emission constant. Standard deviations of calculated parameters are listed, and a plot of a calculated IV curve overlaying the empirical input data is produced.

12088 (SERI/CP—234-1590, pp 91-94) **Different perspective.** O'Connell, T.F. (International Harvester Co., Burr Ridge, IL). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

The economics of agricultural waste harvesting are discussed using corn production and corn stover collection as an example. Surveys indicate that 79 million tons of corn stover are generated each year in the US. The cost of agricultural wastes includes the cost of collection and the replacement costs of nutrients and soil erosion prevention. A reduction in these costs is needed and may be supplied by new technology.

12089 (SERI/CP—234-1590, pp 95-118) **Preparation of biomass for gasification.** Miles, T.R. 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

Biomass materials with their hollow cellulosic cells and high moisture contents need to be dried, cut to useable sizes, and compacted to be utilized for gasification. These preparation processes all require additional energy and become critical factors in the selection of a gasification process for a given biomass feedstock. Data are given on the characteristics of various biomass particles relative to gasification; on energy requirements; and on typical processing equipment. Flowsheets for the supply and preparation of woody and non-woody biomass are presented. (CKK)

12090 (SERI/CP—234-1590, pp 119-149) **Feeding coal and biomass into high pressure reactors.** Guzdar, A.R.; Harvey, A.C. (Foster-Miller Inc., Waltham, MA). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

Current technology of biomass gasification is limited to low pressure operation; however, high pressure processes would be advantageous especially in the biomass-to-methanol process. High pressure gasification requires higher pressures in the solids feeding system also. A technology assessment is given of the available and developmental feed systems currently used for coal gasification, but applicable to biomass feedstocks. Mentioned in some detail are lock hopper systems (especially the Miles Biomass Gasifier Feeder), screw feeders, ram type plug feeders (e.g., Stake Technology feeder), centrifugal plug feeders, piston feeders, and pocket feeders (in particular the Foster-Miller Linear Pocket Feeder). (CKK)

12091 (SERI/CP—234-1590, pp 205-218) **Thagard high-temperature fluid-wall reactor for syngas generation from biomass.** Hornig, A.W. (Baird Corp., Bedford, MA); Theis, J.D. 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

The Thagard High-Temperature Fluid Wall (HTFW) reactor operates in the 1000 to 2500°C temperature range and allows no physical contact between the reacting stream and the reactor's walls. The HTFW reactor has many applications other than gasification, such as chemical processes, ore processing and metal refining, manufacture of refractories, glass, and cement, and waste treatment processes for municipal and industrial wastes, for toxic and hazardous wastes, and for nuclear wastes. These applications are briefly described. When used for the gasification of biomass materials, the high temperature causes the kinetics of the pyrolysis-oxidation-gasification steps to modify so that the syn-gas is composed almost entirely of CO and H_2. High pressures are not necessary and because the reactor is not dependent upon catalysts, purity of feedstocks is not important. Theoretical considerations, empirical work, technology assessment, scaling relationships, and economic considerations of the performance of the HTFW reactor are discussed. A methanol plant in Hercules, CA will soon be retrofitted with a HTFW reactor and will produce metallurgical coke as a by-product. (CKK)

12092 **(SERI/PR—234-1850) Electrochemistry applied to thermal conversion.** Chum, H.L.; Black, S. (Solar Energy Research Inst., Golden, CO (USA)). Nov 1982. Contract AC02-77CH00178. 30p. NTIS, PC A03/MF A01. Order Number DE83005212.

Systems with a reversal of potential near room temperature were investigated for the direct conversion of low-grade heat into electricity in an electrochemical heat engine, Carnot-cycle limited in efficiency. In addition, electrode reactions were selected that can lead to large opposite isothermal temperature coefficients of the electrode potentials [(dE/dT)/sub isoth/] (i.e., large opposite entropies of reactions) under practical battery operating conditions (high concentration of the couples and supporting electrolyte). Two basic types of regeneration are under consideration: systems that generate power at T/sub l/ and that are regenerated at higher temperature - i.e., T > T/sub r/ - spontaneously, or at T < T/sub r/, consuming a fraction of the power generated at T/sub l/; and systems that generate power at T/sub h/ and that are regenerated by cooling - i.e., T < T/sub r/ - spontaneously, or at T > T/sub r/, consuming a fraction of the power generated at T/sub h/. In order to vary the electrode potentials, complex formation was utilized. Twelve electrode reactions involving redox couples of iron(III)/iron(II) and copper(II)/copper and a variety of simple ligands and mixed ligands were investigated in aqueous and acid media. Several of the electrode reactions investigated displayed large and opposite isothermal temperature coefficients, but the final TRES configuration would require an ion-exchange separator.

12093 **(SERI/PR—8002-1-T3) Electrochemical photovoltaic cells/stabilization and optimization of II-VI semiconductors. Third technical progress report, 1 October-31 December 1979.** Nouffi, R.; Tench, D.; Warren, L. (Rockwell International Corp., Thousand Oaks, CA (USA)). 20 Jan 1980. Contract AC02-77CH00178. 36p. NTIS, PC A03/MF A01. Order Number DE83005684.

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The overall goal of this program is to provide the basis for designing a practical electrochemical solar cell based on the II-VI compound semiconductors. Emphasis is on developing new electrolyte redox systems and electrode surface modifications which will stabilize the II-VI compounds against photodissolution without seriously degrading the long-term solar response. The bulk electrode material properties are also being optimized to provide the maximum solar conversion efficiency and greatest inherent electrode stability. Stabilization of n-CdSe against photodissolution has been achieved for the methanol/tetraethylammonium ferro-ferricyanide system. No degradation of the photocurrent or the electrode surface, even in the presence of traces of water, has been observed for runs up to 700 h at 6 mA/cm^2 and AM1 light intensity. In recent studies with higher quality single crystal CdSe as well as polycrystalline CdTe-CdSe photoanodes, stable photocurrents of 7.5 mA/cm^2, corresponding to 4.4% conversion efficiency have been obtained. Through the use of highly purified ferro-ferricyanide electrolytes and/or organic dications, higher conversion efficiencies should be attainable. Preliminary evaluation of a series of sulfur-containing 1,2-dithiolene metal complexes for stabilization of CdX (X=Se, Te, or S) photoanodes in acetonitrile solution has been completed. In certain cases, effective hole capture is indicated and favorable negative shifts in the flatband potentials have been observed. A conducting polymer film (derived from pyrrole) has been electrochemically deposited on a semiconductor electrode. These electrochemically generated polymer films seem to be exceptionally stable and adherent. Studies of the cyanide ion as an electron-transfer mediator in aqueous $Fe(CN)_6^{3-/4-}$ electrolytes, and new directions for chemical modification of CdX electrodes are also discussed.

12094 **(SERI/PR—9318-2-T5) Optimization of transparent electrode for solar cell. Technical report, 15 September 1981-14 September 1982.** Gordon, R.G.; Proscia, J.; Ellis, F.; Kurtz, S. (Harvard Univ., Cambridge, MA (USA)). 1982. Contract AC02-77CH00178. 24p. NTIS, PC A02/MF A01. Order Number DE83002804.

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Electrically conductive, transparent films of fluorine doped tin oxide have been investigated during this contract. These films were grown by the chemical vapor deposition from tetramethyl tin (TMT) in the presence of air and a freon (bromotrifluoromethane). In order to find the optimal conditions for growing high quality films, the concentrations of the reactants were varied, and the resulting film quality was related to a figure of merit (electrical conductance/optical absorbance). This figure is independent of film thickness and increases as the quality of the film is improved. As a further test of quality the variations in the bulk conductivity were also investigated and shown to vary in the same way as the figure of merit. Film growth rates as a function of varying reactant concentrations were determined. Preliminary investigations of fluorine content by Auger spectroscopy were carried out. The surface morphology of the films was studied by scanning electron microscopy, and conditions for growing either smooth or rough films are reported.

12095 **(SERI/STR—231-1819) Emergent aquatics: stand establishment, management, and species screening.** Pratt, D.C.; Andrews, N.J.; Dubbe, D.R.; Garver, E.G.; Penko, M.; Read, P.E.; Zimmerman, E.S. (Minnesota Univ., St. Paul (USA)). Nov 1982. Contract AC02-77CH00178. 61p. NTIS, PC A04/MF A01. Order Number DE83004697.

Several emergent aquatic species have been identified as potential biomass crops, including Typha spp. (cattail), Scirpus spp. (rush), Sparganium spp. (bur reed), and Phragmites (reed). This report discusses first year results from studies of stand establishment and management, Typha nutrient requirements, wetland species yield comparisons, and Typha micropropagation. In a comparison of the relative effectiveness of seed, seedlings, and rhizomes for stand establishment, rhizomes appeared to be more consistent and productive under a wire variety of conditions. Both rhizomes and seedling established plots grew successfully on excavated peatland sites. First season results from a multiyear fertilizer rate experiment indicate that fertilizer treatment resulted in significantly increased tissue nutrient concentrations which should carry over into subsequent growing seasons. Shoot density and belowground dry weight were also significantly increased by phosphorus + potassium and potassium applications, respectively. First season yields of selected wetland species from managed paddies generally were comparable to yields reported from natural stands. Several particularly productive clones of Typha spp. have been identified. A method of establishing Typha in tissue culture is described.

12096 **(SERI/STR—231-1820) Cultivation of macroscopic marine algae.** Ryther, J.H. (Florida Univ., Gainesville (USA)). Nov 1982. Contract AC02-77CH00178. 32p. NTIS, PC A03/MF A01. Order Number DE83004696.

The red alga Gracilaria tikvahiae may be grown outdoors year-round in central Florida with yields averaging 35.5 g dry wt/m^2.day, greater than the most productive terrestrial plants. This occurs only when the plants are in a suspended culture, with vigorous aeration and an exchange of 25 or more culture volumes of enriched seawater per day, which is not cost-effective. A culture system was designed in which Gracilaria, stocked at a density of 2 kg wet wt/m^2, grows to double its biomass in one to two weeks; it is then harvested to its starting density, and anaerobically digested to methane. The biomass is soaked for 6 hours in the digester resi-

due, storing enough nutrients for two weeks' growth in unenriched seawater. The methane is combusted for energy and the waste gas is fed to the culture to provide mixing and CO_2, eliminating the need for aeration and seawater exchange. The green alga Ulva lactuca, unlike Gracilaria, uses bicarbonate as a photosynthesis carbon source, and can grow at high pH, with little or no free CO_2. It can therefore produce higher yields than Gracilaria in low water exchange conditions. It is also more efficiently converted to methane than is Gracilaria, but cannot tolerate Florida's summer temperatures so cannot be grown year-round. Attempts are being made to locate or produce a high-temperature tolerant strain.

12097 **(SERI/TR—332-417) Survey of the electrochemistry of some biomass-derived compounds.** Chum, H.L.; Osteryoung, R.A. (Solar Energy Research Inst., Golden, CO (USA)). Dec 1982. Contract AC02-77CH00178. 65p. NTIS, PC A04/MF A01. Order Number DE83004725.

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A literature survey of the electrochemistry of selected biomass-derived compounds is presented. Chemicals successfully synthesized electroorganically from mono- and polysaccharides include dialdehyde starch, aldonic acids, and polyalcohols. In general, such synthesis aim at speciality chemicals. Fuel cells employing poly- and monosaccharides generate low power densities. The electrochemical production of energy-intensive chemicals, petrochemical substitutes, or commodity chemicals from biomass-derived compounds has not been addressed in the literature. Recommendations for future research are made which encourage the electrochemical research of polymeric materials resulting from newly developed pretreatments of biomass, such as explosive decompression and organosolv pretreatments of wood. Because lignins are the only renewable source of phenolic compounds, electrochemical research of these materials is strongly encouraged.

12098 **(SERI/TR—9100-1-T4) Exploratory development of thin-film polycrystalline-silicon photovoltaic devices. Final technical report.** Sarma, K.R.; Gurtler, R.W.; Rice, M.J. Jr.; Ellis, J.; McIntosh, G.; Legge, R.; Sopori, B. (Motorola, Inc., Phoenix, AZ (USA)). Sep 1981. Contract AC02-77CH00178. 189p. NTIS, PC A09/MF A01. Order Number DE83003859.

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The overall ribbon-to-ribbon (RTR) process sequence may be divided into major steps; progress in each of them has contributed to advancement of the overall technology. The molybdenum sheets on which microcrystalline silicon thin films are deposited must be re-used many times for reasons of economy. Electropolishing was found to be an effective way of resurfacing the molybdenum for continued use. Deposition rate and efficiency of silicon microcrystalline films on molybdenum substrates were shown to be enhanced (over CVD) by utilizing a high pressure plasma (HPP). A microribbon deposition system was designed for continuous operation under microprocessor control. Acid etching to remove surface contamination layers from microcrystalline films before RTR was found to be more reproducible than plasma or hot alkali etching. Laser beam RTR (LB-RTR) growth station improvements have given more reliable operation, very clean ribbons, and larger grains. An electron beam RTR (EB-RTR) system was designed and partially completed. Preliminary results (under partial control) have produced thin films with properties comparable to LB-RTR ribbons. Characterization of RTR solar cell substrates has shown that the main barrier to efficiencies $>$ 10 to 11% is high dislocation density ($\sim 10^6/cm^2$).

12099 **(TENRAC/EDF—017) Demonstration of solar-energy conversion of agricultural or industrial wastes to fuels. Final report.** Morris, J.A.; Milligan, D.J.; Quick, J.A. Jr.; Mann, G.W. (Dow Chemical Co., Midland, MI (USA)). Aug 1979. 113p. NTIS, PC A06/MF A01. Order Number DE83900801.

The investigation reported was to evaluate the potential of using marine algae in the production of renewable energy, to investigate the technical feasibility of such a system, and to identify the problems that must be resolved for the process to be successful. Techniques for producing algae biomass were conducted in 750-gallon outdoor pools and in a one-acre pilot plant. Algae produced from the one-acre pilot plant was used to evaluate various harvesting techniques. Both algae harvested from the pilot plant and from the smaller experimental pools were used for conversion studies in laboratory-sized anaerobic fermenters. (LEW)

12100 **(TENRAC/EDF—052) Demonstration of biomass-derived fuels for integrated energy farm.** (SumX Corp., Austin, TX (USA)). 20 Oct 1981. 142p. NTIS, PC A07/MF A01. Order Number DE83900874.

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In October 1980, SumX Corporation initiated a program to design, construct, and demonstrate an Energy Integrated Farm System on the Del Valle Hog Farm in Del Valle, Texas. Specifically, SumX Corporation intends to determine and demonstrate the technical and economical feasibility of methane production derived from the anaerotic digestion of swine manure and the reliability of this process as an alternative energy source for electrical generation and fuel alcohol production. A schematic of the proposed facilities and materials handling is shown. To establish a basis for design and analysis of the specific proposed facilities, an inventory of existing facilities, farm operations, and energy use patterns was conducted. The results of this inventory provide the initial input data for equipment sizing and potential energy integration. Approximately 100,000 pounds of hogs are fed continuously and generate approximately 1500 pounds of readily collectable dry manure solids per day. These hogs are fed a high protein diet consisting of milo, which is produced and stored on the farm, and soy bean meal. Electricity, butane, and motor fuels are the primary types of energy required by this typical farm operation.

12101 **(TENRAC/EDF—053) Unconventional plants for biomass feedstocks in semi-arid West Texas. Final report.** Goodin, J.R.; Newton, R.J. (Texas Tech Univ., Lubbock (USA). Dept. of Biological Sciences; Texas A and M Univ., College Station (USA). Dept. of Plant Sciences). Aug 1981. 77p. NTIS, PC A04/MF A01. Order Number DE83900822.

The objectives of the reported project are: to evaluate the establishment and productivity potential of four plant species in West Texas as influenced by rainfall, temperature, and minimum cultural practices; to accurately assess the present distribution and acreages inhabited by the four candidates in West Texas as well as the soil, geographical, and climatic factors which govern their adaptation; and to provide productivity data in order to make adequate economic and sociological assessments of biomass production in West Texas. The four species selected are HONEY MESQUITE (Prosopis glandulosa Torr.), JOHNSONGRASS (Sorghum halepense (L.) Pers), KOCHIA (Kochia scoparia (L.) Roth), and SALTBUSH (Atriplex canescens (Pursh.) (Nutt.). (LEW)

12102 **(TENRAC/EDF—065) Economic and engineering evaluation of plant oils as a diesel fuel. Final report.** Engler, C.R.; LePori, W.A.; Johnson, L.A.; Griffin, R.C.; Diehl, K.C.; Moore, D.S.; Lacewell, R.D.; Coble, C.G.; Lusas, E.W.; Hiler, E.A. (Texas Agricultural Experiment Station, College Station (USA)). 15 Apr 1982. 160p. NTIS, PC A08/MF A01. Order Number DE83900805.

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The annual total yield of plant oils in the US is about 3.7 billion gallons. Diesel use by agriculture is about 2.0 billion gallons annually and is growing rapidly relative to gasoline use. Based on these amounts, plant oils could satisfy agriculture's diesel fuel requirements during the near future. However, diversion of large quantities of plant oils for such purposes would have dramatic impacts on plant oil prices and be reflected in numerous adjustments throughout agriculture and other sectors of the economy. The competitive position of sunflowers for plant oil production in Texas was analyzed. In those regions with a cotton alternative, sunflowers were not, for the most part, economically competitive. However, sunflower production is competitive with grain sorghum in certain cases. To develop a meaningful production base for oilseed crops in Texas, yields need to be improved or increases in oilseed prices relative to cotton must take place. This implies some limitations for the potential of Texas to produce large quantities of plant oils.

12103 **(TENRAC/EDF—066) Ethanol production in small- to medium-size facilities. Final report.** Hiler, E.A.; Coble, C.G.; O'Neal, H.P. (Texas A and M Univ., College Station (USA)). Apr 1982. 152p. NTIS, PC A08/MF A01. Order Number DE83900875.

In early 1980 system design criteria were developed for a small-scale ethanol production plant. The plant was eventually acquired from Coulter Copper and Brass Company in Toronto and was installed on November 1, 1980. It has a production capacity of 30 liters per hour; this can be increased easily (if desired) to 60 liters per hour with additional fermentation tanks. Sixty-six test runs have been conducted to date in the alcohol production facility. Feedstocks evaluated in these tests include: corn (28 runs); grain sorghum (33 runs); grain sorghum grits (1 run); half corn/half sorghum (1 run); and sugarcane juice (3 runs). In addition, a small bench-scale fermentation and distillation system has been used to evaluate sugarcane and sweet sorghum feedstocks prior to their evaluation in the larger unit. In each of these tests, evaluation of the following items was conducted: preprocessing requirements; operational problems; conversion efficienty (for example, liters of alcohol produced per kilogram of feedstock); energy balance and efficiency; nutritional recovery from stillage; solids separation by screw press; chemical characterization of stillage including liquid and solids fractions; wastewater requirements; and air pollution potential.

12104 **(TENRAC/EDF—074) On-site energy production from agricultural residues. Final report.** Hiler, E.A. (Texas A and M Univ., College Station (USA). Center for Energy and Mineral Resources). Apr 1982. 83p. NTIS, PC A04/MF A01. Order Number DE83900814.

Gasification experiments were carried out in a 51 mm diameter fluidized bed using cotton gin trash, sorghum stalks, corn cobs and rice hulls as feedstocks. Differences exist in the gas composition and heating value produced by these feedstocks, but each can be used satisfactorily in a fluidized-bed gasifier. The predominant products of gasification suitable for combustion are carbon monoxide, hydrogen and methane. Preferred operating conditions are 760°C at atmospheric pressure. The quality of gas produced at these conditions is primarily a function of the fuel-to-air ratio. Typical heating values of gases produced by gasification are: cotton gin trash-6.26 MJ/m^3, sorghum stanks-7.74 MJ/m^3, rice hulls-9.71 MJ/m^3, and corn cobs-8.22 MJ/m^3. Particulate removal from the low energy gas produced by a 30 cm diameter fluidized bed was evaluated using a two-stage cyclone.

12105 **Clostridium thermoautotrophicum species novum, a thermophile producing acetate from molecular hydrogen and carbon dioxide.** Wiegel, J.; Braun, M.; Gottschalk, G. (Universitaet Goettingen, Germany). *Current Microbiology;* **5**: 255-260(1981). Contract AS09-79ER10499.

Fourteen strains of a thermophilic, rod-shaped, peritrichously flagellated Clostridium species were isolated from various mud and soil samples. Round to slightly oval spores were formed in terminal position. The isolates were obligate anaerobes and grew chemolithotrophically with H_2 plus CO_2 as well as chemoorganotrophically with fructose, glucose, glycerate, or methanol. Under both conditions, acetate was the only organic fermentation product formed in significant amounts. The pH optimum for growth was 5.7; the marginal temperatures for growth were T/sub min/, 36°C; T/sub opt/, 56 to 60°C; and T/sub max/, 69/70°C. The DNA contained 53 to 55 mol% guanine plus cytosine. The isolated strains form a new clostridial species; the name Clostridium thermoautotrophicum is proposed.

12106 **Forage crops can be a source of ethanol.** *Chemical and Engineering News;* **58**: No. 36, 52(8 Sep 1980).

The possible use of forage crops as feedstocks for ethanol production is being investigated by the Solar Energy Research Institute. Such crops such as Sudan grass, alfalfa and ensiled sorghum have lower lignin contents than woody plants and should be easier to convert to fermentable sugars. The fixed capital investment appears to be about $2.00 per gallon of ethanol capacity.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 12009, 12015, 12046

12107 **(CONF-811175—, pp 1-12) Technological aspects of solar energy utilization.** Bloss, W.H. (Universitaet Stuttgart, Germany). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

Technologies for converting solar radiation into heat, electrical energy, and chemical energy or biomass are briefly reviewed. Methods of conversion into heat include passive systems and flat plate collectors, and use of collectors for solar refrigeration, solar dryers, solar stills, and mechanical or electric power generation is discussed. Concentrating systems are also included, as are heat storage systems. The method of direct conversion to electricity given is the photovoltaic system, and applications are briefly discussed, as also are batteries. Biomass production by photosynthesis is discussed along with applications. (LEW)

12108 **(CONF-811175—, pp 129-136) Technological aspects of the mixed use of solar and wind energy.** Busch, N.E.; Moellenbach, K. (Risoe National Lab., Roskilde, Denmark). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

A very general discussion is given of the mixed use of solar and wind energy. A definition of the mixed use of solar and wind energy is formulated. It is found that the meteorological data available for judging the potential for mixed use of solar and wind energy is insufficient. In particular it would be advisable to seek analytical methods based on meteorological principles enabling an estimation of the potential of mixed use of solar and wind energy as compared to the individual use of the two. It is also of interest to study correlations between the energy production potential and the consumption patterns. The technological aspects of mixed use of solar and wind energy are discussed with the approach of energy systems analysis. Two cases are of particular interest. One is supply of space heating where evidence is found in the few experiments performed of a possible reduction in needs for storage capacity and auxiliary energy input. The electricity producing systems are the second focal case. Computer simulations show a possible enhanced utility capacity displacement. Further consideration of the systems leads to the statement that the technical methods of interest for mixed use of solar and wind energy is demanding with regard to technical and industrial infrastructure and skill.

12109 **(DOE/ET/20279—170) Photovoltaic-array/power-conditioner interface.** Branz, H.M.; Hart, G.W.; Cox, C.H. III. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Oct 1982. Contract AC02-76ET20279. 136p. NTIS, PC A07/MF A01. Order Number DE83004946.

Two years' of effort to improve terrestrial flat-plate photovoltaic (PV) system efficiency through increased understanding of the array/power conditioner interface is reported. The flat-plate PV array is a highly variable source of dc electrical energy due to changing insolation and other factors. Computer simulation based on statistically typical weather data is used to analyze the terrestrial flat-plate PV source and to define the optimal characteristics of its interface with the power-conditioning subsystem. It is found that less than 5% of the annual available energy will be lost by operating most PV systems at a fixed voltage and that even after array degradation, maximum-power-point tracking usually will not present a significantly larger advantage over fixed-voltage operation. Experiments show that open-loop tracking using a new pilot-cell concept is also a viable array-operating strategy. Finally, power conditioner sizing is examined and techniques are developed for estimating the annual operating efficiency and the maximum dc voltage requirement of a power conditioner.

12110 **(DOE/ET/20279—180-Vol.5) Power processing subsystems for the 100-kWp solar-photovoltaic-power system at the Natural Bridges National Monument in Utah.** Solman, F.J.; Coleman, S.D. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 30 Jun 1982. Contract AC02-76ET20279. 201p. NTIS, PC A10/MF A01. Order Number DE83005246.

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The power processing subsystem for the Natural Bridges National Monument photovoltaic power system including inverters, battery chargers, battery, diesel generator, site transfer switch, transformer in-rush controller, furnace loads, and load control equipment are described. Components and subsystem testing are also discussed. Also included are the solution to operational problems.

12111 **(DOE/ET/20279—222) Impact of residential utility-interactive PV-power systems on the utility.** Fitzer, J.; Dillon, W.E.; Rajas-Negrete, C.R.; Chen, B.K. (Texas Univ., Arlington (USA)). Sep 1982. Contract AC02-76ET20279. 123p. NTIS, PC A06/MF A01. Order Number DE83004695.

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The results of a study of the potential impact of a significant number of utility-interactive photovoltaic power systems on an electric utility distribution feeder are reported. The study was done using a computer simulation of a utility feeder. The computer simulation was based on measurements of voltage and load at the substation for the feeder, as well as simultaneous measurements of the performance of a residential PV system operating in the same geographical area. The performance of this PV system was used to model the effects of varying numbers of PV sources on the feeder. The effects of PV-generated power on the distribution system voltage, the line losses and the power demand at the substation are reported. Different inverter power factors were considered. Harmonic voltages due to inverter harmonic currents were studied.

12112 **(SAND—81-7080/4) Intermediate photovoltaic system application experiment operational performance report. Volume 4. For G.N. Wilcox Memorial Hospital, Kauai, Hawaii for June, July, and August 1982.** (Boeing Computer Services Co., Seattle, WA (USA)). Dec 1982. Contract AC04-76DP00789. 74p. NTIS, PC A05/MF A01. Order Number DE83005380.

Presented are the data accumulated during June, July, and August 1982 at the intermediate photovoltaic project at G.N. Wilcox Memorial Hospital, Kauai, Hawaii. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weater are provided.

12113 **(SAND—81-7083/1) Intermediate photovoltaic system application experiment operational performance report. Volume 1. Dallas-Fort Worth Regional Airport, TX, July 1982.** (Boeing Computer Services Co., Seattle, WA (USA)). Nov 1982. Contract AC04-76DP00789. 27p. NTIS, PC A03/MF A01. Order Number DE83004763.

The data accumulated during July at the intermediate photovoltaic project at Dallas-Fort Worth Regional Airport, Texas are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

12114 **(SAND—81-7085/14) Intermediate photovoltaic system application experiment operational performance report. Volume 14. For Lovington Square Shopping Center, Lovington, New Mexico, July and August 1982.** Harrison, T.D. (Boeing Computer Services Co., Seattle, WA (USA)). Dec 1982. Contract AC04-76DP00789. 48p. NTIS, PC A03/MF A01. Order Number DE83005381.

Presented are the data accumulated during July and August at the intermediate photovoltaic project at Lovington Square Shopping Center, Lovington, New Mexico. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

12115 **(SAND—81-7086/14) Intermediate photovoltaic system application experiment, July and August 1982 operational performance report. Volume 14. For Newman Power Station, El Paso, Texas.** (Boeing Computer Services Co., Seattle, WA (USA)). Jan 1983. Contract AC04-76DP00789. 40p. NTIS, PC A03/MF A01. Order Number DE83005377.

Presented are the data accumulated during July and August at the intermediate photovoltaic project at Newman Power Station, El Paso, Texas. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

12116 **(SAND—81-7087/3) Intermediate photovoltaic system application experiment operational performance report. Volume 3. For Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma.** (Boeing Computer Services Co., Seattle, WA (USA)). Oct 1982. Contract AC04-76DP00789. 45p. NTIS, PC A03/MF A01. Order Number DE83005379.

Presented are the data accumulated during May at the intermediate photovoltaic project at Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma. Generated energy and environmental for (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

12117 **(SAND—81-7087/6) Intermediate photovoltaic system application experiment operational performance report. Volume 6. For Oklahoma Center for Science and Arts, Oklahoma City, OK for October 1982.** (Boeing Computer Services Co., Seattle, WA (USA)). Dec 1982. Contract AC04-76DP00789. 26p. NTIS, PC A03/MF A01. Order Number DE83005489.

Presented are the data accumulated during October 1982 at the intermediate photovoltaic project at Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

12118 **(SAND—81-7188) Initial detailed designs for intermediate photovoltaic systems: office building.** Herz, J.; O'Brien, G. (General Electric Co., Philadelphia, PA (USA)). Jul 1982. Contract AC04-76DP00789. 198p. NTIS, PC A09/MF A01. Order Number DE83005365.

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A detailed design is presented for a 140 kW ground mounted flat plate array photovoltaic system to serve a three-story office building. The design is analyzed for performance and economics. Building architectural features and load demands are defined. Photovoltaic array, electrical system design, and system installation are discussed, along with alternative design choices. Specifications and installation details are included. (LEW)

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 12107, 12108, 12179, 12181, 12622

12119 **(DOE/ET/21106—T1) Uv protective coatings for heliostats and the plastic dome. Final technical report.** Baum, B.; Bansleben, E.; McGrath, P. (Springborn Labs., Inc., Enfield, CT (USA)). Nov 1981. Contract AC01-79ET21106. 90p. D. Order Number DE83000948.

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Fluorocarbon and acrylic coatings and films were explored as a means of preventing uv degradation of: (1) the polyester (Petra A) film used in the heliostat dome, (2) the first surface silvered polyester (Melinex O) heliostat, (3) the first surface silvered float glass heliostat, as well as (4) and with other coatings to prevent silver spotting of the back surface of a superstrate, second surface heliostat mirror. Uv stabilization systems were developed and tested. The coated or laminated structures were evaluated for adhesion, resistance to high humidity and acid vapor degradation, percent transmittance/ reflectance, water spotting (for case 4 above), and uv stability under the RS-4 Sunlamp (wet and dry). Promising materials were subjected to accelerated outdoor exposure at Desert Sunshine Testing (DSET) in Arizona. Specific uv stabilized acrylic

coatings and/or acrylic or fluorocarbon films offered some protection for the Petra A, silvered Melinex O and first surface silvered float glass against weathering, or in case 4 moisture, degradation. However, no system was satisfactory for long term outdoor weathering. Phenoxy primers showed initial promise for back surface protection against silver spotting but require further in depth study.

12120 **(DOE/SF/10499—46) Heliostat washing equipment requirements (RADL Item 7-17). 10-MWe solar-thermal central-receiver pilot plant: solar facilities design integration.** (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Sep 1982. Contract AC03-79SF10499. 28p. (SAN—0499-46; MDC-G—8250). NTIS, PC A03/MF A01. Order Number DE83001673.

The requirements for washing heliostats at the Barstow Solar Pilot Plant are established. The major objectives are to determine the requirements for an economically feasible technique that is both environmentally acceptable and effective in removing desert soil from the heliostat surfaces in order to achieve cost effective mirror reflectivity. Three candidate systems are outlined and their costs compared. (LEW)

12121 **(MDC-G—8544-Vol.3) Pilot-plant station manual (RADL Item 2-1). Volume III. Equipment data. 10-MWe solar-thermal central-receiver pilot plant: solar-facilities design integration.** (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Sep 1982. Contract AC03-79SF10499. 180p. (SAN—0499-57-Vol.3). NTIS (US Sales Only).

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Detailed equipment data are compiled on major components within the receiver/tower, thermal storage, and control and instrumentation systems, and, where available, the balance of plant for the Barstow Solar Pilot Plant. Included are specifications and engineering drawings. (LEW)

12122 **(SAND—80-2560) Shenandoah Solar Total-Energy Project.** Leonard, J.A.; Hunke, R.W. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 10p. NTIS, PC A02/MF A01. Order Number DE83005244.

The design and construction of the world's first solar total-energy plant in the private sector has been completed and checkout is underway. During its operational phase, the solar plant will furnish electrical power, process steam, and other thermal energy to a nearby knitwear factory. The solar system consists of a collector field containing 114 parabolic-dish collectors which supply thermal energy at 400°C to drive a 400 kW multi-stage Rankine-cycle turbine generator. Some steam is extracted from the turbine and supplied to the knitwear manufacturing processes. The system will be grid-connected. Presented are: (1) a description of the system and components being installed; (2) a summary of performance testing of the extraction turbine and of four prototype parabolic-dish collectors; and (3) a discussion of design considerations and insights which have general applicability to solar-thermal-system designs.

12123 **(SAND—82-8027) 10-MWe central-receiver solar-thermal pilot plant data-evaluation plan.** Radosevich, L.G. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 56p. NTIS, PC A04/MF A01. Order Number DE83005035.

This report describes the Data Evaluation Plan for the 10 MWe Central Receiver Solar Thermal Pilot Plant near Barstow, California. The objective, test and data needs, approach, applicability, expected output, and planned data dissemination are presented for each evaluation.

12124 **(TENRAC/EDF—054) Field optimization for the solar repowering of an electric utility near Abilene, Texas. Final report.** Vant-Hull, L.L. (Houston Univ., TX (USA)). 8 Jul 1981. 61p. NTIS, PC A04/MF A01. Order Number DE83900821.

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The overall study analyzed use of a sodium cooled central receiver utilizing a surrounding field of heliostats to provide 226 MW peak of solar power to storage in a hot sodium tank. Upon demand this hot sodium is pumped to steam generators where 135 MW of steam at 12 MPa (1800 PSI) and 538°C (1000°F) is generated. Particular concern is with the cost effective optimization of the heliostat field to occupy a highly constrained peninsula of land available at the site. Detailed performance data for the resulting field is also provided. The approach to collector field optimization has been modified to ease and improve the method of optimization on sites subject to severe land constraints. A sound conceptual design has been developed for solar central receiver repowering of a 110 MWe gas fired turbine operated by the West Texas Utilities. The levelized busbar energy cost is 82.2 mills/kWh. As expected, the current economics are not favorable for this plant, but they become favorable if heliostat costs are reduced to $150/m² ($14/ft²) either through government subsidy or through mass production economics.

12125 **(UCLA—12/1385) Environmental effects of solar-thermal power systems: ecological observations during early testing of the Barstow 10-MWe pilot STPS.** Turner, F.B. (ed.). (California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences). Nov 1982. Contract AC03-76SF00012. 54p. NTIS, PC A04/MF A01. Order Number DE83004454.

Environmental measurements were continued at Solar One during 1982, while final steps in construction and early testing were carried out. Measurements of sand depths downwind (east) of the heliostat field indicated that some of the sand blown off the field (most of it between September 1979 and March 1980) has been carried farther east, reducing sand depths somewhat in areas just east of the field. Observations of birds between March and June 1982 revealed that (1) the natural avifauna of the field has been altered, although the area is still used for feeding by some icterids (larks, blackbirds) and aerial insectivores (swallows, swifts); (2) of 15 bird casualties ascribable to the presence and/or operation of Solar One, 12 followed collisions with heliostats, three resulted from incineration in heliostat beams; (3) the central receiver tower does not appear to be a source of mortality. Numbers of rodents (particularly kangaroo rats) trapped in areas downwind of the site declined steadily between 1978 and 1982 in areas both clost to the field and as far east as 600 m from the fence. The most likely interpretation of these changes is a reduction in reproductivity and/or early survival caused by four consecutive years (1978, 1979, 1980, 1981) of suboptimal autumn rainfall. Micrometeorological measurements in areas downwind of Solar One showed small effects on air temperatures (<0.5°C), wind speeds (<0.4 m/sec), and evaporation rates (<1.5 ml/hr).Effects were detected only in areas 100 to 190 m from the east perimeter fence. Because these differences are so small, relative to natural heterogeneities, the effects of Solar One on rates of evaporation, air temperatures and wind speed will not affect the downwind biological community. The relavance of these findings to construction of a larger solar thermal power plant (e.g., Solar 100) are considered.

12126 **(UCLA—12/1388) Wind-flow field measurements in the wake of the Barstow Solar-Thermal Power Plant.** Radkey, R.L.; Zambrano, T.G. (California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences). Nov 1982. Contract AC03-76SF00012. 31p. NTIS, PC A03/MF A01. Order Number DE83004451.

A brief flow field measurement study was conducted at the Barstow 10 MW Solar Thermal Power PLant to determine the effect of the plant on the local wind flow field and to identify resulting possible environmental implications. Wind speed measurements were taken at a reference free stream location and at a number of locations in the wake downstream of the plant. Measurements were taken to about 400 m (1312 ft) downstream with wind shear profiles taken to a height of 50 m (164 ft) AGL at each point in the wake. With the heliostats up, the data showed a wake deficit (wind speed reduction) of about 15% from reference extending over the downstream extent of the measurements. This wake is believed to be detectable 1000 to 2000 m (3280 to 6560 ft) downstream of the plant. With the heliostats stowed, no wake deficit was observed. With this modest wind speed reduction, any accumulation of wind blown particulates will occur within the heliostat field or just downstream within 60 m (197 ft) in the near wake. A brief analysis indicated that if a 100 MW array of the same heliostats is

constructed, the wake will extend over a height and a downstream extent, roughly similar to the 10 MW plant but increased in size, directly proportional to the linear scale (diameter) of the plant. The magnitude of the wake deficit for a plant of infinite diameter should not exceed twice the deficit observed for the 10 MW plant. Thus, the wind related environmental effects should be essentially of the same magnitude for a 100 MW plant as for the existing 10 MW plant.

12127 **10-MWe Solar-Thermal Central-Receiver Pilot Plant: solar-facilities design integration. Integrated (operational) piping and instrumentation diagrams (RADL item 2-38) (Engineering Materials).** (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). (CAPE—2771). Contract AC03-79SF10499.

36 aperture cards.

The piping and instrumentation of the Barstow Solar Pilot Plant is illustrated in a set of schematic drawings. Systems diagrammed include: receiver, thermal storage, power generation, feedwater, cooling water, drains, turbine control oil and lube oil, service water, water treatment, fire protection, instrument air and service air systems. (LEW)

12128 **10-MWe Solar-Thermal Central-Receiver Pilot Plant: solar-facilities design integration. Pilot plant station manual (RADL item 2-1). Volume 2. Drawings (Engineering Materials).** (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). (CAPE—2770). Contract AC03-79SF10499.

54 aperture cards.

A set of electrical drawings, general arrangement drawings, piping and instrumentation diagrams, and plot and layout plans are compiled to illustrate the Barstow Solar Pilot Plant. (LEW)

1408 Ocean Thermal Gradient And Salinity Gradient Power Systems

12129 **(DOE/CH/00135—1) Heat exchanger cleaning in support of ocean thermal energy conversion (OTEC) - electronics subsystems.** Lott, D.F. (Naval Coastal Systems Center, Panama City, FL (USA)). Dec 1980. Contract AI02-79CH00135. 54p. (NCSC-TM—296-80). NTIS, PC A04/MF A01. Order Number DE83005846.

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Electronics systems supporting the development of biofouling countermeasures for Ocean Thermal Energy Conversion (OTEC) are described. Discussed are the thermistor/thermopile amplifiers, heaters, flowmeters, temperature measurement, control systems for chlorination, flow driven brushes, and recirculating sponge rubber balls. The operation and troubleshooting of each electronic subsystem is documented.

12130 **(DOE/CH/00135—2) Heat exchanger cleaning in support of ocean thermal energy conversion (OTEC) - mechanical subsystem.** Lott, D.F. (Naval Coastal Systems Center, Panama City, FL (USA)). Dec 1980. Contract AI02-79CH00135. 39p. (NCSC-TM—297-80). NTIS, PC A03/MF A01. Order Number DE83005844.

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The mechanical systems supporting biofouling countermeasures for Ocean Thermal Energy Conversion (OTEC) are discussed. Described are the water supply and distribution and the flow driven brush, recirculating sponge rubber ball, and chlorination systems. In addition, the maintenance procedures utilized at the NCSC test site are provided.

12131 **(DOE/CH/00135—4) Calibration of sonic flowmeters for Ocean Thermal Energy Conversion (OTEC).** Lott, D.F.; Salsman, G.G.; Hodges, C.E. (Naval Coastal Systems Center, Panama City, FL (USA)). Dec 1980. Contract AI02-79CH00135. 34p. (NCSC-TM—295-80). NTIS, PC A03/MF A01. Order Number DE83005840.

A commercially available acoustic flowmeter has been used to monitor critical flow conditions relative to the effects of biofouling on the efficiency of a prototype heat transfer system during the OTEC (Ocean Thermal Energy Conversion) funded study. The special procedures devised to calibrate the flowmeters are documented. The calibration consisted of pumping seawater through the flowmeter into a tank suspended beneath a special load cell which provided an output voltage proportional to the weight of water in the tank. A programmable desktop calculator system was used to monitor changes in voltage as a function of time, and convert these changes into flow rates for direct comparison with values read from the sonic flowmeter's digital display. Calibration checks were made at metered flows of 8, 10, 12, 14, 16, and 18 gallons per minute (gpm). It was found that computed flows were essentially linear but differed from metered values by as much as 9.0%.

12132 **(ORNL/TM—8384) Study of hydraulic air compression for Ocean Thermal Energy Conversion open-cycle application.** Golshani, A.; Chen, F.C. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 88p. NTIS (US Sales Only). Order Number DE83005155.

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A hydraulic air compressor, which requires no mechanical moving parts and operates in a nearly isothermal mode, can be an alternative for the noncondensible gas disposal of an Ocean Thermal Energy Conversion (OTEC) open-cycle power system. The compressor requires only a downward flow of water to accomplish air compression. An air compressor test loop was assembled and operated to obtain test data that would lead to the design of an OTEC hydraulic air compressor. A one-dimensional, hydraulic gas compressor, computer model was employed to simulate the laboratory experiments, and it was tuned to fit the test results. A sensitivity study that shows the effects of various parameters on the applied head of the hydraulic air compression is presented.

12133 **(PB—82-257536) Ocean thermal energy at the Johns Hopkins University Applied Physics Laboratory, quarterly report. Report for Jan-Mar 82.** (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). 1982. 42p. NTIS, PC A03/MF A01.

The following are included: Ocean thermal energy conversion (OTEC)–OTEC pilot plant conceptual design review; OTEC methanol; review of electrolyzer development programs and requirements; financial and legal considerations in OTEC implementation; potential navy sites for GEOTEC systems; hybrid geothermal-OTEC power plants: single-cycle performance estimates; and supervision of testing of pneumatic wave energy conversion system.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 12022, 12022, 12057, 12107, 12107, 12112, 12179, 12579

12134 **(DOE/CH/10116—1) First year's performance data of the NCSU Solar Energy and Conservation House.** (North Carolina State Univ., Raleigh (USA). Dept. of Mechanical and Aerospace Engineering). Nov 1982. Contract AC02-82CH10116. 23p. NTIS, PC A02/MF A01. Order Number DE83004800.

The NCSU Solar Energy and Conservation House has 2000 square feet of floor area and contains a two-story embedded sunspace, two Trombe walls, active solar hot water heating for domestic use, thermal storage in a rock filled ceiling/floor, and numerous research treatments, and energy conservation features. The house is completely decorated and furnished in an attractive manner and the exterior architecture is traditional and has broad consumer appeal. The house is open to the public on weekdays and numerous people and various groups come to visit on their own initiative and others take advantage of the close proximity to McKimmon while attending conferences there. The overall thermal performance of the house greatly exceeds initial predictions and expectations. For instance, only 660 kWh of electricity (cost of $39.60 in 1981-1982) were used by the heat pump to heat the house for the entire winter of 1981-1982. That winter season experienced 3554 heating degree days and consequently such a low heating consumption represents truly remarkable thermal performance and design. Similarly, the house performed well during a typically hot and humid summer in

central North Carolina. The heat pump consumed 1157 kWh of electricity ($69.42) for the entire summer of 1982.

12135 (DOE/CH/10122—7) **Proceedings of the solar-hot-water field-test technical review meeting.** (ESG, Inc., Atlanta, GA (USA)). Sep 1982. Contract AC02-82CH10122. 334p. (CONF-820753—). NTIS, PC A15/MF A01. Order Number DE83001147.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

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Separate abstracts were prepared for 16 papers in this conference proceedings. (LEW)

12136 (DOE/CH/10122—7, pp 7-25) **SDG and E solar heating system data reduction and analysis techniques.** Miles, J.S.; Taylor, R.W. (San Diego Gas and Electric, CA). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

Since 1978 more than ninety solar water heating systems have been monitored. It was necessary to establish a method for evaluating the data obtained from these systems, so a computer program was developed. Techniques are described to reduce, analyze and compare solar water heating systems. Seven performance calculation methods used in the computer program are discussed. Also, three methods are presented to compare solar water heaters to gas water heaters. These three methods establish a means for determining solar energy savings.

12137 (DOE/CH/10122—7, pp 27-33) **Solar domestic hot water project.** Albright, S. Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

The Solar Domestic Hot Water (DHW) Project involves the monitoring of 30 solar DHW systems with electric backup heating elements. The systems are located in Albuquerque and Santa Fe, New Mexico. The project objectives are to determine the (1) performance, (2) economics, and (3) load characteristics of the average solar DHW system. To accomplish this, the solar DHW systems were compared to a group of conventional electric DHW systems. The results found in this paper are from comparisons made from January 1980 to December 1980. The average solar DHW system consumed 40 percent less electrical energy (kWh) in its operation than the average conventional electric DHW system. This resulted in an average savings of $132 for the year. Taking into account a $3000 initial system cost, tax credits, annual savings, inflation, utility increases, and tax deductions, a net present value (NPV) analysis showed the average solar DHW to have a net positive cash value after seven years. In addition to the consumer benefits, the solar DHW systems' averaged group diversified demand during the PNM system peak was 42 percent lower than that of the conventional DHW system group. This makes solar DHW systems an attractive load management alternative to conventional electric DHW systems. The project has shown benefits to both the utility and the customer.

12138 (DOE/CH/10122—7, pp 35-49) **Performance and reliability of residential solar water heaters.** Perlman, M. (Ontario Hydro Research Div., Toronto). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

Five solar water heaters installed in private residences proved to be reliable over a year of continuous operation and monitoring. Observations revealed that retrofit installations were not difficult. Summer efficiencies as high as 90 per cent were recorded while, on the average, the year-round solar contribution was about 33 per cent. No major problems occurred after commissioning. Typical performance and hot water draw profiles are presented, and specific aspects of the operation, performance and system reliability are analyzed.

12139 (DOE/CH/10122—7, pp 51-74) **Measurement and data reduction techniques: solar water preheat systems, Illinois Power Company.** Rand, H.J. (Illinois Power Co., Decatur); Clausing, A.M. Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

Eighteen solar water pre-heating systems were installed in residences throughout Illinois Power Company's (IP) service territory beginning in the fall of 1977. These systems, initially draindown type, were modified in May, 1979, when external heat exchangers were installed to permit conversion to closed-loop glycol systems. Water meters in conjunction with magnetic tape survey-type electric meters were used to record critical information. A computer program was written to aid the analysis of the data, and calculate performance data. Peak load effects were derived from the survey-type meter tapes.

12140 (DOE/CH/10122—7, pp 75-87) **Evaluating water heating alternatives.** Royster, R.L. (Carolina Power and Light Co., Raleigh, NC). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

In 1981 monitoring of four alternative water heating systems which appear to have the potential to reduce energy consumption and/or shift demand to off peak periods was began. A total of 86 customers are participating in the evaluations. The four systems being evaluated are: (1) solar water heaters, (2) heat pump water heaters, (3) heat recovery from heat pumps, and (4) large capacity super insulated water heaters operated during off-peak hours. Magnetic tape metering equipment monitors electrical consumption and water flow meters monitor hot water usage. It was determined that the best common denominator for evaluating all systems from an electric utility standpoint was gallons of hot water per kWh of electricity. This terminology is also readily understood by consumers, manufacturers, installers, and home owners. Btu meters were also installed on the solar systems but data gathering to date has been severely restricted because of failures in components of the metering equipment. The evaluation is to continue through August of 1983. Preliminary data gathering indicates that we are securing the type of data which will provide us the factual information necessary to more accurately advise our residential customers on alternative water heating systems in future years.

12141 (DOE/CH/10122—7, pp 89-107) **Solar assist water heating.** Stacken, M. (Kansas Power and Light Co., Topeka, KS). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

A very simple method of collecting data from only two meters (an electric meter and a water meter) and evaluating the efficiency of a solar assisted water heating system is presented.

12142 (DOE/CH/10122—7, pp 109-123) **Bonneville Power Administration's solar domestic hot water monitoring program - program administration and technical issues.** White, T. (Bonneville Power Administration, Portland, OR). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

A pilot program to learn how a utility can encourage the use of solar domestic hot water technology in the Pacific Northwest is described. Monitoring provides the basis for determining the extent to which solar hot water will displace electrical energy use and to examine hot water electrical energy use profiles over time when back-up resistance heat is used. The analysis of the data obtained is then described. Procedures for measuring tank heat losses are given, and some other problems are discussed. (LEW)

12143 (DOE/CH/10122—7, pp 125-173) **Monitoring and performance of solar domestic hot water systems in Oregon.** Baker, M.S. Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

A study has been undertaken to monitor Solar Domestic Hot Water (DHW) Systems in Oregon. During the monitoring program,

37 solar DHW systems were monitored across Oregon, along with 8 conventional electric waters heaters used as a control group. These monitoring sites were located in a variety of urban and rural settings in the various climate zones of Oregon. The solar DHW systems monitored included most of the common system types including antifreeze, draindown, drainback, air and thermosyphon systems. All of the solar DHW systems monitored used electricity for auxiliary heating. Most of the results reported were for the calendar year of 1981. The monitoring approach used recording water meters, watt-hour meters, elapsed time meters, and thermometers which were read on a monthly basis. As well, short term measurements were taken of the standby losses of the auxiliary tanks. The monitoring methodology was found to be surprisingly accurate on a monthly and seasonal basis using the conventional electric water heaters as control sites. Monitoring data was summarized on a monthly and annual basis. In general, there was a wide variation in solar DHW system performance. Standby losses were found to be much larger than initially anticipated. Hot water usage had a median value of 20 gallons/day per person, with a large variation between sites and on a monthly basis. The typical system met about 40% of the energy needs for water heating and saved about 1900 kWh/y during 1981. When considering the energy required to operate solar pumps, motors, valves, and controls, the median solar fraction was reduced to 36%. However, some of the better sites were meeting better than 70% of the annual DHW needs and were saving 3000 kWh/y of electricity. The most recently installed systems appear to be performing better than the older systems.

12144 (DOE/CH/10122—7, pp 175-184) **Monitoring solar water heater performance by alternating between resistance and solar systems.** Burnett, T.D. (Portland General Electric, Portland, OR). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

The monitoring plam and analysis methodology for Portland General Electric's Solar Water Heater Program is presented. The key element of this plan is that at each monitoring site hot water production is alternated between the solar system and the previous resistance system. This procedure allows for the estimation of site specific tank losses, annual energy saved, and solar savings fraction. The results of the analysis are presented. The data is then reanalyzed using a regional estimate of tank loss. A numerical and technical comparison is made between these two methodologies. As a result of this comparison, it is apparent that the method using the regional estimate of tank losses leads to biases in the estimation of individual site solar savings fractions and annual energy savings. These biases may or may not be present when the results are viewed on an aggregate basis.

12145 (DOE/CH/10122—7, pp 185-209) **Comparison of the results from six regional solar water heater field test programs.** Jones, W.M. (ESG, Inc., Atlanta, GA). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

Thermal performance data gathered from monitored in-field solar water heaters is discussed. Operational procedures and metnodologies utilized by the on-going monitoring program and thermal performance data from various monitoring programs located in the eastern United states are presented. Accumulated performance data are reduced according to the methodologies presented. This is done so that comparative analyses can be made for various geographical locations. The data consist of performance in the form of annual energy saved, solar savings fraction, and gallons/purchased energy. These data shows the differences between the geographical locations of each of the six regional monitoring programs as well as the differences and variations within a given program's monitoring period.

12146 (DOE/CH/10122—7, pp 211-217) **Uses and abuses of f-chart.** Lau, A. (ESG, Inc., Atlanta, GA). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

The primary limitations of the f-chart design method for predicting actual energy usage and savings of solar domestic hot water systems are discussed. The f-chart method applies to a wide range of system design and usage parameters, but does not account for four major factors. These are non-recurring daily draw patterns, load management of backup elements, parasitic energy consumption for pumps and controls, and energy consumption of the conventional system. The meaning of the solar fraction, f, derived from f-chart is also discussed and related to other definitions of solar fraction. The bottom line is that field testing is more appropriate for determining actual performance of SDHW and conventional systems.

12147 (DOE/CH/10122—7, pp 219-247) **Results of TVA monitoring of residential solar water heaters.** Chaffin, D.J.; Askew, G.L.; Vine, D.H.; Wessling, F.C. (Tennessee Valley Authority, Chattanooga, TN). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

The results from two field monitoring programs and an outdoor laboratory test program are presented. Savings are estimated in comparison to a well insulated conventional electric water heater supplying the same thermal load. Summer and winter electric load profiles are shown in comparison to the conventional water heater. Water use patterns are presented. The design implications of the monitoring and test data are examined. Tank heat losses and heat exchangers were shown to be areas of concern. The need for minimal monitoring for the system owner was identified and a possible monitoring scheme was proposed.

12148 (DOE/CH/10122—7, pp 249-262) **Solar domestic hot water monitoring - what we have learned.** Aungst, W.K. (Pennsylvania State Univ., Middletown, PA). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

Beginning in November of 1968, solar domestic hot water (SDHW) systems installed in private residences were monitored, using a low-cost instrumentation package, thru September of 1981. The findings of a Site Inspection Project carried out during the summer of 1981 are summarized. The Site Inspection Project carried out in Pennsylvania was initiated with the specific purpose of attempting to determine why some SDHW systems perform so much better than other very similar systems. To accomplish the objective, the results of the monitoring project for the calendar year 1980 were summarized so that the forty-two sites monitored could be ranked from the best performance to the poorest performance. Four criteria were used: % Solar or Solar Fraction; Solar Energy utilized by the systems per unit area of collector surface; C.O.P., which in this case is total estimated energy used divided by the total purchased energy, and finally the estimated total annual energy saved by the SDHW system. Using the criteria given above, the ten best and ten poorest performing sites were inspected and the homeowners interviewed. The results of this Site Inspection Project indicate that the major differences between the two groups (good and poor performing SDHW systems) can be classified into installation or system differences and system use or system interction differences. The differences found are summarized and a recommendation as to how future SDHW system performance can be improved is given.

12149 (DOE/CH/10122—7, pp 263-295) **Solar monitoring by Pacific Gas and Electric Company.** Costa, J.B. (Pacific Gas and Electric Co., San Francisco, CA). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

The attached three reports demonstrate the evolution of solar monitoring at the utility. The first report focuses on the mistakes made in the first efforts to monitor in field solar applications. Appended are descriptions of some of the systems that were monitored, and the problems with those systems. The second report is the proposed revision of the utility's monitoring scheme. It contains the outlines of the utility's objectives in monitoring, and the criteria for selecting monitoring systems. Several forms are appended which may serve as models for other persons considering monitor-

ing solar systems. The third and final attachment is an example of one of the utility's present monitoring reports.

12150 (DOE/CH/10122—7, pp 297-306) **Operational status of 134 solar water heaters in the southeastern United States.** Jacobs, R.A. (ESG, Inc., Atlanta, GA). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

Little information is available on the reliability of different solar system types along with the different types of problems encountered. Information concerning the operational status of 134 systems currently being monitored is presented.

12151 (DOE/CH/10122—7, pp 307-314) **Early-life maintenance requirements of 124 HUD-approved SDHW systems installed between 1978 and 1980.** Odegard, D.S. (Northern Energy Corp., Boston, MA). Sep 1982. NTIS, PC A15/MF A01.

From Solar hot water field test technical review meeting; Atlanta, GA, USA (14 Jul 1982).

Maintenance requirements for 124 HUD-approved solar domestic hot water (SDHW) systems over a period of about two years are presented and discussed. The findings indicate that almost half of the systems required no maintenance and that, except for control system failures and collector fogging, the solar components exhibited about the same frequency of maintenance as did the backup system. Solar control system failures and installation errors on many different conmponents indicate that controls need reliability-related research and installers should be selected with care.

12152 (DOE/CS/30339—T1) **Gunnison County airport terminal (Project Number 339). Final report.** Waller, L.H.; Kreider, J.F. (Associated Architects of Crested Butte, CO (USA); Kreider (Jan F.) and Associates, Inc., Boulder, CO (USA)). 30 Nov 1982. Contract FC02-80CS30339. 129p. NTIS, PC A07/MF A01. Order Number DE83004512.

Portions of document are illegible.

The Gunnison Airport includes a number of solar and energy conservation features: south reflective surface for improved winter solar gain, Trombe wall, night setback, summer vent system, clerestory, high heat recovery ducts, task lighting, high levels of wall insulation, HPS lighting, direct gain slar system and slab storage, operable windows, and airlock entries. After a summary of weather data collected in Gunnison, Colorado, the building performance is presented. The nature and magnitude of all connected loads at the airport are described, and the magnitude of solar contribution is evaluated and discussed using measured weather data. Performance prediction methods used during design are evaluated relative to their accuracy. Owner's and designers perspectives are presented, and information dissemination efforts are described. (LEW)

12153 (DOE/CS/30386—T1) **Manufactured buildings solar project. Final report.** (Science Applications, Inc., Albuquerque, NM (USA)). 1981. Contract FC02-80CS30386. 123p. NTIS (US Sales Only). Order Number DE83004108.

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The purpose of the reported project was to introduce passive solar energy concepts into the product line of Wausau Homes, Inc., a prominent manufacturer of panelized homes currently marketed in the north-central region of the United States. The work covered is the development of designs for passive solar heating and cooling. A direct gain, solar attic, and integrated direct gain plus solar attic passive solar house designs resulted. The company history, product line, and construction and marketing requirements are described briefly. The design process is documented from concept development, through schematic design, design synthesis. (LEW)

12154 (DOE/R5/10148—1) **Dwyer Mercer County District Library. Semi-annual technical progress report.** (Dwyer-Mercer County District Public Library, Celina, OH (USA)). 31 Dec 1979. Contract FG02-79R510148. 22p. NTIS (US Sales Only). Order Number DE83005506.

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Bidding difficulties and actual on-site progress are described. Information is given on changes in design and specifications of new materials. (MHR)

12155 (DOE/R5/10252—2) **Cooperative passive-solar commercial retrofit. Final report, September 1, 1980-December 31, 1982.** Brown, W.T. (Stevens Point Area Co-op, WI (USA)). Dec 1982. Contract FG02-80R510252. 14p. NTIS (US Sales Only). Order Number DE83005269.

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The primary objectives of this project were: the conversion of an existing south-facing storefront into a trombe'-wall passive solar collector, the sharing of information on simple low-cost energy alternatives with the local community, and the reduction of the store building's dependence on non-renewable fossil fuel for space heating. Six 6' wide pre-assembled collector glazing panels were mounted on a 12' high by 36' long portion of the south-facing masonry wall. Vent-holes were cut through the wall at each panel to provide air inlets and outlets for the collector and monitoring equipment was installed to record performance. A series of hands-on construction workshops were attended by Co-op and community members. During these sessions, collector components were assembled. The panels were installed on April 22, 1981 in celebration of Earth Day. Additional sessions were held to complete the project, make necessary modifications and install sensors. Project personnel participated in several energy-education activities, including workshops, seminars and alternative energy home tours. A community-based energy resource council was founded with the assistance of several key Co-op project members and a fully-illustrated How-To manual, entitled Passive Solar Collector: A Trombe'-Wall Retrofit Guide was published. Finally, a variety of energy conservation measures were undertaken. These included a new airlock store entry, insulated store ceiling, destratification ceiling fans and wood-burning furnaces have combined with the passive solar collector to substantially reduce the use of fuel oil for heat.

12156 (DOE/R5/10314—2) **Trombe wall performance study in the Upper-Midwest. Final report.** Bolkcom, J.; Fuller, R. (Gustavus Adolphus Coll., St. Peter, MN (USA). Dept. of Physics). Nov 1982. Contract FG02-81R510314. 143p. NTIS (US Sales Only). Order Number DE83003135.

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The objective of the project was the study of the performance of Trombe wall systems when used in the Upper-Midwest. This was accomplished by building two highly instrumented full Trombe wall models. The data acquisition system was based on a 6502 microcomputer and permitted data points to be obtained every 15 minutes during each operating day. After obtaining base-line data, the configuration of one of the models was varied in a controlled manner to determine performance effects of important variables such as natural convection through vent ports or insulting shutter effects in front of the wall. Finally, a thermal diffusion model is used to make performance calculations for the Trombe Wall models. The experimental data compares well with the diffusion model calculations. The conclusions of this study provide suggestions on the use of Trombe Wall systems in the Upper-Midwest climate.

12157 (DOE/R5/10327—2) **Solar-heated greenhouse utilizing water reservoir. Final technical progress report. Appropriate-Technology Small-Grants Program.** Marshaus, M.E. (Marshaus Berry Farms, Defiance, OH (USA)). 27 Dec 1982. Contract FG02-81R510327. 14p. NTIS, PC A02/MF A01. Order Number DE83004797.

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The initial goal of our proposed project was to construct and equip a 2000 square foot glass greenhouse which would be in production from early April through November, utilizing only solar energy heating. The project consisted of capturing the excess heat produced by the sun's rays during daylight hours, storing it in a water reservoir, and then releasing and reusing that stored heat energy to maintain a desirable night time temperature and favorable growing environment without the use of fossil fuels. A solar collector made from 500 feet of one inch black plastic water pipe was attached to the lower portion of the southern roof section. Water is pumped through this collecting coil for fifteen minute intervals

each daylight hour, and then into a series of 80 fifty-five gallon steel drums painted black and connected one to another. Heat collected during the day is stored in these water filled drums and is then released during night time hours when outside temperatures fall. The steeldrums are positioned in such a way that no floor space is wasted. Racks, made of one inch galvanized pipe were welded and laid directly on top of the steel drum reservoir. The plastic flats filled with seedlings and transplants were then placed on these racks. Not only did this utilize all available growing space, but it placed the plants directly above the warmed water circulated and stored in the reservoir.On April 1, 1982, the first flats of transplanted seedlings were moved into the new house. By May 20, 1982, over 90,000 flower and vegetable plants from seedlings had grown to fully developed transplants. Total fuel costs were approximately $20.00.

12158 **(DOE/R5/10333—3) Passive-solar collector: a Trombe'-wall retrofit guide.** Brown, T.; Dostal, M. (Stevens Point Area Co-op, WI (USA)). 1982. Contract FG02-80R510252;FG02-81R510333. 35p. NTIS, PC A03/MF A01. Order Number DE83005189.

Step-by-step instructions are given for converting existing south-facing masonry walls into Trombe walls. Locally-available materials are used for the most part and minimal carpentry skills are required. Some design variations and modifications are suggested. Performance monitoring and operation and maintenance are discussed. Costs are estimated to total $374. A way is given to estimate energy savings. (LEW)

12159 **(EUR—8164-EN) Final progress report for European Modelling Group.** Verdier, B. (Commission of the European Communities, Luxembourg). 1982. 125p. European Community Information Service, 2100 M Street, N.W., Suite 707, Washington, DC 20037.

An hourly simulation code called HABSOL achieved by Commissariat a l'Energie Atomique (France) is described. This code is written in Fortran and simulates in the presented version the solar pilot test facilities built in eight countries of Europe. The structure of HABSOL includes a conversational form concerning most descriptors of the installation, allows easy replacing of one component by another, thus permits simulations of various solar systems and fine sensitivity analyses. Some results of validation are presented and one can see that there is a good agreement between measured and calculated values, so these validations make this code a good tool to forecast performance of solar heating power plants. Equations of the model are presented as well as the iteration method to solve them. The cost of a simulation run is quite low.

12160 **(LA-UR—82-870) Preliminary economic assessment or residential passive solar cooling potential in the United States.** Kirschner, C.; Mangeng, C.; Yemans, M.; Roach, F. (New Mexico Univ., Albuquerque (USA). Dept. of Economics; Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 7p. (CONF-820629—1). NTIS, PC A02/MF A01. Order Number DE82012152.

From American section of the International Solar Energy Society conference; Houston, TX, USA (1 Jun 1982).

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In many areas of the continental United States, residential cooling loads are equal to or greater than energy used for residential space heating. Offsetting part of the cooling load could yield considerable dollar savings to the consumer as well as total energy savings. The physical performances of three passive cooling designs are used to estimate the dollar value of first-year fuel savings (excluding heating benefits) and a maximum affordable design cost. The designs include natural ventilation, forced ventilation, and evaoprative cooling concepts. Because economic performance is primarily governed by the level of electricity prices, dollars savings are greatest in regions that show both good physical performance of the cooling design and high electricity prices. Physical and economic performance summaries are presented in mapped form for 220 solar regions within the continental United States.

12161 **(LA-UR—82-3525) Fast correlation method for passive-solar design.** Wray, W.O.; Biehl, F.A.; Kosiewicz, C.E. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 10p. (CONF-821222—1). NTIS, PC A02/MF A01. Order Number DE83004731.

From COMES international passive solar research and design conference; Cannes, France (13 Dec 1982).

A passive-solar design manual for single-family detached residences and dormitory-type buildings is being developed. The design procedure employed in the manual is a simplification of the original monthly solar load ratio (SLR) method. The new SLR correlations involve a single constant for each system. The correlation constant appears as a scale factor permitting the use of a universal performance curve for all passive systems. Furthermore, by providing location-dependent correlations between the annual solar heating fraction (SHF) and the minimum monthly SHF, we have eliminated the need to perform an SLR calculation for each month of the heating season.

12162 **(LA-UR—82-3634) SLR methods for attached sunspaces.** Jones, R.W.; McFarland, R.D. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 11p. (CONF-821156—1). NTIS, PC A02/MF A01. Order Number DE83004741.

From 3. energy conserving greenhouse conference; Hyannis, MA, USA (19 Nov 1982).

Solar load ratio (SLR) methods applied to sunspaces are reviewed. Procedures are described both for the 28 sunspace basic design types and for the design variations that can be accommodated within the SLR method. Emphasis is placed on aspects of design, operation, and analysis that relate to the production of both plants and heat. Issues discussed include geometry, shading of mass, temperature limits, and energy loss caused by the exfiltration of water vapor.

12163 **(NP—3900964) Sunspaces: design and build an attached solar greenhouse.** Kent, B. (Maine Office of Energy Resources, Augusta (USA)). 1982. 10p. NTIS (US Sales Only). Order Number DE83900964.

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Instructions are given on how to design and build an attached solar greenhouse for house space heating. Examples are given of three existing sunspaces in Maine, one of which is illustrated in section, plan, and south elevation drawings as well as construction details and material specifications. Costs, fuel bill savings, and tax credits are discussed briefly. (LEW)

12164 **(PB—82-254863) Solar/gas Rankine/Rankine-cycle heat pump assessment. Final report Mar 81-Jul 82.** Ezzat-Khalifa, H.; Melikian, G. (United Technologies Research Center, East Hartford, CT (USA)). Jul 1982. 208p. (UTRC-R—82-955621). NTIS, PC A10/MF A01.

This report contains an assessment of the technical and economic feasibility of Rankine-cycle solar-augmented gas-fired heat pumps (SAGFHP) for multi-family residential and light-commercial applications. The SAGFHP design considered in this report is based on the successful UTRC turbocompressor system which has been tested both in the laboratory and in a solar cooling installation in Phoenix, AZ. An hour-by-hour modeling of present-design SAGFHP performance in multi-family and office buildings in New York, Wisconsin, Nebraska and Oregon indicated that, even without solar augmentation, primary energy savings of up to 17% and 31% could be achieved relative to advanced furnace plus electric air conditioning systems and electric heat pumps, respectively. Extensive design and economic evaluations of the SAGFHP were conducted for a wide range of solar collector areas, thermal storage capacities, natural gas and electricity prices and economic assumptions.

12165 **(PB—82-260100) Thermal performance case studies for residential solar heating and cooling systems. Final report.** Cremeans, A.H.; Hedden, R.E. (Mueller Associates, Inc., Baltimore, MD (USA)). Jun 1982. 167p. (MAI—213). NTIS, PC A08/MF A01.

This document presents five case studies on thermal performance of selected solar system designs which served as a vehicle for examining the applicability of the Draft Performance Criteria for Solar Heating and Cooling Systems in Residential Buildings. The purpose of this document was to identify shortcomings in the draft version of the performance criteria by means of attempting to implement the criteria. Those aspects of the criteria that require revision were highlighted.

12166 **(PB—83-102301) Solar-augmented applications in industry. Phase II: conceptual designs, volume 1. Final report Jun 80-Dec 81.** Casper, R.A.; Kearney, D.W.; Williams, J.H. (Insights West, Inc., Los Angeles, CA (USA)). Jul 1982. 192p. NTIS, PC A09/MF A01.

The objective of this project was to carry out conceptual designs of solar/gas energy systems for industrial process heat applications at the plants of selected industrial participants. Agreements were secured from eight industrial firms to participate in a solar/gas IPH conceptual design program. The conceptual designs were completed as planned, examining the solar/gas interface, process energy needs, the solar system requirements, and the economics of the installation. Five of the designs were recommended for consideration as field test sites. Subsequent field development activities are being deferred pending a detailed assessment of the RandD required for cost-competitive solar/gas systems.

12167 **(PB—83-102319) Solar/gas Brayton/Rankine cycle heat pump assessment. Final report Apr 81-May 82.** Rousseau, J.; Liu, A.Y. (AiResearch Mfg. Co., Torrance, CA (USA)). May 1982. 102p. NTIS, PC A06/MF A01.

A 10-ton gament-fired heat pump is currently under development. This heat pump features a highly efficient, recuperated, subatmospheric Brayton-cycle engine which drives the centrifugal compressor of a reversible vapor compression heat pump. The investigations under this program were concerned initially with the intergration of this machine with a parabolic dish-type solar collector. Computer models were developed to accurately describe the performance of the heat pump packaged in this fashion. The study determined that (1) only a small portion (20 to 50 percent) of the available solar energy could be used because of a fundamental mismatch between the heating and cooling demand and the availability of solar energy, and (2) the simple pay back period, by comparison to the baseline non-solar gas-fired heat pump, was unacceptable (15 to 36 years). The program was modified to include investigations of a solar-assisted gas-fired cogeneration system. In this arrangement the subatmospheric Brayton engine produces electrical power and use is made of the engine waste heat at temperatures up to 400F. Parametric data were generated in terms of engine duty cycle and waste heat utilization fraction. The economic analyses show very attractive return on investment for this system, even for very conservative economic factors.

12168 **(TENRAC/EDF—026) Passive-solar heating and cooling demonstration project. Final report.** Beyer, G. (Southside Community Center, San Marcos, TX (USA)). Aug 1980. 57p. NTIS, PC A04/MF A01. Order Number DE83900799.

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The greenhouse in this project demonstrates a retrofit to a commercial type building, an installation which is not on the longer side of the building, construction without skilled labor, and the potential for obtaining an attractive appearance with a retrofit sunspace. In retrofit configurations, energy storage in thermal mass is quite expensive, but this design uses water stored in inexpensive plastic bottles as energy storage and is intended to supply 65% of building heating load. The isolated greenhouses and building air loops help to control building humidiy and plant insect problems. The project was conducted in several phases, weatherization, greenhouse construction, solar system monitoring, and food production. The first two phases have been completed and monitoring equipment has been planned. Food production programs are currently underway. Activities have been coordinated with the local C.A.P. in developing a food production distribution program which includes greenhouse vegetable production, seedling production, community/neighborhood/individual gardening, food co-ops, and low cost solar greenhouse retrofit.

12169 **(TENRAC/EDF—056) Design procedure for solar industrial-process-heat systems in Texas. Final report.** Treat, C.H.; Green, S.T.; Moseley, P.K.; Deffenbaugh, D.M. (Southwest Research Inst., San Antonio, TX (USA)). 31 Aug 1981. 90p. NTIS, PC A05/MF A01. Order Number DE83900819.

The objective of this project is to develop a design procedure for the application of solar energy to industrial-process-heat systems in Texas. The method is organized to allow the user to estimate the annual thermal performance of a particular system, estimate the total installed cost of that system, and provide a means for determining the return on that investment. A single example is carried through to illustrate the procedure. The example is of an actual installation and thereby provides a basis for judging the accuracy of the procedure. In addition to this example, suggestions are provided for performing optimization studies. In a given industrial situation any of several solar options might be selected. A comparison of four of these options at a specific plant site illustrates that one option in particular yields an acceptable return on investment while the three remaining do not. The advantage of this procedure, therefore, is that it provides a simple, straightforward method for distinguishing between those applications which are cost effective and those which are not.

12170 **(TENRAC/EDF—064) Solar-regenerated desiccant dehumidification. Final report.** Haves, P. (Trinity Univ., San Antonio, TX (USA)). 9 Feb 1982. 146p. NTIS, PC A07/MF A01. Order Number DE83900823.

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The dehumidification requirements of buildings are discussed, and the most suitable desiccant material is identified as silica gel. Several conceptual designs for solar regenerated desiccant dehumidifiers using a solid desiccant are described. The construction and operation of a laboratory experiment to determine the performance of a packed bed of silica gel at low flow rate is described. The experimental results are presented and compared to the predictions of a simple computer model which assumes local equilibrium between the desiccant and the airstream. The simulations used to predict desiccant bed performance and the integration of the desiccant bed simulation with a simulation of the thermal performance of a passively cooled residence are described. Results for an average July day are presented. Sizing relationships derived from the simulation are described, and an economic analysis and recommendations for further work are presented. (LEW)

12171 **(TENRAC/EDF—072) Demonstrate use of solar energy for laundromat washing and drying. Final report.** Whitacre, J.A. (Texas Univ., El Paso (USA)). 31 May 1982. 32p. NTIS, PC A03/MF A01. Order Number DE83900816.

A solar system was designed and installed to supply energy to a university laundry. The purpose of the project was to demonstrate the use of solar energy in both the washing and drying processes of laundry operations and to determine the expected gas energy savings. The limited performance data available indicate a 30% saving in gas consumption while laundry operations were running at about 35% capacity. Tt is expected that 40% or more will be saved at near capacity operation. The solar system, retrofitted to an existing building, is composed of 120 parabolic trough collectors, a 2500 gallon storage tank, and supporting pumps and heat exchangers. The system is operated with a minimum of controls and performed satisfactorily with no interruptions of laundry operations. The use of solar energy to displace gas energy in laundries appears to be practical. The amount of gas to be saved is limited by the desired temperatures of the preheated air to the dryers.

12172 **(TENRAC/EDF—080) Solar-assisted heat pumps and alternative-energy-awareness demonstration. Final report.** Wetzel, O.K. Jr. (Tejas Girl Scout Council, Inc., Dallas, TX (USA)). 11 Sep 1981. 23p. NTIS, PC A02/MF A01. Order Number DE83900808.

The water to air solar assisted heat pump installation is added to an existing service/training center in Dallas, Texas. The design uses three separate water systems. The first consists of the solar collectors, circulating pump, draindown tank, heat exchanger, attendant piping and controls. The second is a closed loop system

consisting of an insulated buried steel tank, an above ground expansion tank, the loop water circulating pump, the backup gas boiler, and the cooling tower. It serves six heat pumps. The third system is an open system for the cooling tower, consisting of a pump, spray heads in the cooling tower. The operation of each of the three systems is described. The system's thermodynamic efficiency is discussed, as well as a solar domestic hot water system. System performance is found to be much less than expected, with a solar fraction estimated at 30% as opposed to an expected 80%. A self-teaching solar awareness demonstration in the building is described. (LEW)

12173 **(TENRAC/EDF—082) Passive-solar homes for Texas.** Garrison, M. (Texas Univ., Austin (USA). School of Architecture). 1982. 188p. NTIS (US Sales Only). Order Number DE83900806.

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Acceptance of passive-solar technologies has been slow within the conventional building trades in Texas because it is a common misconception that solar is expensive, and data on local applications is severely limited or nonexistent. It is the purpose of this solar development to move passive-solar design into the mainstream of public acceptance by helping to overcome and eliminate these barriers. Specifically, the goal is to develop a set of regional climatic building standards to help guide the conventional building trade toward the utilization of soft-energy systems which will reduce overall consumption at a price and convenience most Texans can afford. To meet this objective, eight sample passive-design structures are presented. These designs represent state-of-the-art regional applications of passive-solar space conditioning. The methodology used in the passive-solar design process included: analysis of regional climatic data; analysis of historical regional building prototypes; determination of regional climatic design priorities and assets; prototypical design models for the discretionary housing market; quantitative thermal analysis of prototypical designs; and construction drawings of building prototypes.

12174 **Corona del Sol High School solar system, Tempe Union High School District No. 213. Final technical report (Engineering Materials).** (Ahern-MacVittie-Hofmann and Goodwin Architects Ltd., Tempe, AZ (USA); Timmerman Engineering Co., Inc., Phoenix, AZ (USA); Tempe Union High School District No. 213, AZ (USA)). (CAPE—2772). Contract AC01-76CS32393.

250 aperture cards.

Presented is a description, summarization of theoretical operating analysis, and review comments of a solar assisted space heating and service hot water heating system installed at Corona del Sol High School in Tempe Union High School District, Tempe, Arizona. The solar collectors used for the project are dual-glazed, flat plate type and cover a gross area of 20,563 sq ft or an aperature area of 17,675 sq ft facing due south at an angle of elevation of 32 degrees. Collected energy is stored in an underground, steel tank with a volume of 50,000 gallons. The entire system is designed for collection and storage of 1.3×10^6 Btu of energy at the design day of January 21, at 33 degrees N. Lat. The total system installed cost was $893,172 in a cost sharing agreement between the Department of Energy (DOE) and Tempe Union High School District (TUHS). The DOE portion of installed costs was $805,122 with TUHS providing the remaining $88,050. Translating the overall installed cost into a relationship with the collector's, one finds a cost of $43 per sq ft of installed collector.

12175 **Micro-macropore model for sorption of water on silica gel in a dehumidifier.** Ghezelayagh, H.; Gidaspow, D. (Illinois Inst. of Tech., Chicago). *Chemical Engineering Science;* 37: No. 8, 1181-1197(1982).

A mathematical model for laminar flow through a duct of an isothermally maintained dehumidifier and for simultaneous diffusion and absorption of water vapor into a desiccant was formulated as an integral equation. The macro-micro pore model for the desiccant was fitted to transient experimental data for isothermal adsorption of water on a silica gel sheet with an average deviation of four percent. The data could not be explained by the conventional Rosen model which considers diffusion in the macropores only. A Graetz type analysis of experimental data showed that the mass transfer in the channel could be approximated by constant mass transfer coefficients which agreed with the asymptotic Nusselt numbers for the laminar Graetz problems. However, the corresponding mass transfer coefficients for the desiccant are highly time dependent. Hence a more complicated model is required. Groups of researchers are applying this unit operation to solar powered desiccant air conditioning systems.

1410 Solar Collectors And Concentrators

12176 **(DOE/CS/14287—T2) Optimization of solar-selective paint coatings. Final report, September 15, 1980-June 15, 1982.** McChesney, M.A.; Zimmer, P.B.; Lin, R.J.H. (Honeywell, Inc., Minneapolis, MN (USA)). Jun 1982. Contract AC04-78CS14287. 69p. NTIS, PC A04/MF A01. Order Number DE83001278.

The objective of this program was the development of low-cost, high-performance, solar-selective paint coatings for solar flat-plate collector (FPC) use and passive thermal wall application. Thickness-sensitive selective paint (TSSP) coating development was intended to demonstrate large-scale producibility. Thickness-insensitive selective paint (TISP) coating development was intended to develop and optimize the coating for passive solar systems and FPC applications. Low-cost, high-performance TSSP coatings and processes were developed to demonstrate large-scale producibility and meet all program goals. Dip, spray, roll, laminating and gravure processes were investigated and used to produce final samples. High-speed gravure coating was selected as the most promising process for solar foil fabrication. Development and optimization of TISP coatings was not completely successful. A variation in reflective metal pigment was suspected of being the primary problem, although other variables may have contributed. Consistent repeating of optical properties of these coatings achieved on the previous program was not achieved. However, a new method of achieving better control of coating components was conceived and preliminary development initiated. The new concept was described as an engineered pigment approach. The engineered pigment approach uses TSSP-coated metal foil particles instead of uncoated aluminum flakes in a liquid TSSP coating. The approach offers many advantages over the use of uncoated aluminum flakes: control of particle flatness, size, and thickness; control of the optical selectivity of each particle; and control of the liquid TSSP coating surrounding the coated particles.

12177 **(DOE/CS/30131—T1) Evaluation of SUNPACK tube vacuum quality. Final report, 1 September 1978-31 May 1980.** Moan, K.L. (Owens-Illinois, Inc., Toledo, OH (USA)). Nov 1982, Contract AC04-78CS30131. 58p. NTIS (US Sales Only). Order Number DE83005113.

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The viability of all glass, selectively coated, evacuated tubular solar collectors has been demonstrated in many field installations now in operation. Some questions remain concerning the cost of the collector tubes and the long-term durability of the hermetically-sealed vacuum jacket. The work performed under this contract addresses parts of both these questions. A major and critical process step in collector tube manufacture is the bake-out process. Contract work was aimed at: first, investigating the possible elimination of this step, and second, the shortening of the process time required and the reduction of capital equipment required to produce good quality collector tubes. The long term durability of the vacuum jacket, direct breakage aside, depends on the permeation rate of atmospheric gases into the jacket through the glass. From prior scientific investigation, the most likely atmospheric constituent gas to cause this problem is Helium. Helium is a minor constituent of air having a partial pressure of 4×10^{-3} Torr. If, however, this equilibrium pressure could be reached in the vacuum jacket, heat conduction losses would take place from the tube in operation, causing a degradation of collector performance. Various aspects and tests concerning this phenomenon are investigated under the contract.

12178 **(DOE/CS/34285—T1) Evaluation of solar selective coating stability. Final report, September 1, 1978-May 31, 1980.** Spanoudis, L. (Owens-Illinois, Inc., Toledo, OH (USA)). Nov 1982. Contract AC04-78CS34285. 68p. NTIS, PC A04/MF A01. Order Number DE83005112.

Methods were investigated for increasing the cost effectiveness of evacuated tubular collectors through the use of antireflective (AR) coatings and by increasing the high temperature stability. Both surfaces of the cover tube were successfully AR treated using a method found in the patent literature. The AR coating increased the transmittance from 0.92 to 0.98. A number of thin film materials were found to be effective as AR overcoats for the CrO/sub x//Al selective coating. Prototype collector tubes with a MgF_2 AR coating had absorptivities of 0.89 and emissivities of 0.058 with excellent thermal stability. The mechanism of thermal degradation in a CrO/sub x//Al coating was concluded to be a reaction between the Al and the CrO/sub x/ which accelerates with increasing temperature. The reaction becomes more evident as the Al thickness decreases. The reaction is impeded through the use of barrier coatings between the Al and CrO/sub x/ and by isolating the CrO/sub x//Al coating through the use of undercoats and topcoats. The most thermally stable coating was obtained by substituting Cu for Al. Some development work remains in preventing premature degradation of the Cu during glass sealing and annealing. An excellent selective coating proprietary to the vendor was applied by Denton Vacuum of Cherry Hill, New Jersey. A new selective coating was prepared where a metal and a dielectric were co-evaporated in reverse concentration gradients onto metallized coupons. Coatings with high absorptivities were obtained with Al + MgF_2, Cu + MgF_2, Ag + MgF_2 and Cr + MgG_2. Additional development work is required to apply these coatings onto tubes.

12179 **(DOE/JPL—1060-56) Survey of manufacturers of solar-thermal-energy systems.** Levine, N.; Slonski, M. (Jet Propulsion Lab., Pasadena, CA (USA)). Aug 1982. Contract AI01-76ET20307. 97p. (JPL-PUB—82-94). NTIS, PC A05/MF A01. Order Number DE83005140.

Sixty-seven firms that had received Department of Energy (DOE) funding for development of solar thermal energy systems (STES) were surveyed by telephone in 1981. The primary goal of the survey was to assess the effect of the DOE Solar Thermal Technology Systems program in accelerating STES development. The 54 firms still developing STES were grouped into a production typology comparing the three major technologies with three basic functions. It was discovered that large and small firms were developing primarily central receiver systems, but also typically worked on more than one technology. Most medium-sized firms worked only on distributed systems. Federal support of STES was perceived as necessary to allow producers to take otherwise unacceptable risks. Approximately half of the respondents would drop out of STES if DOE support were terminated, including a disproportionate number of medium-sized firms. A differentiated view of the technology - taking into account differing firm sizes and the various stages of technology development - was suggested for policy and planning purposes.

12180 **(SAND—82-1600) Development of a solar-flux tracker for parabolic-trough collectors.** Boultinghouse, K.D. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1982. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01. Order Number DE83005361.

The development of a solar-flux tracker for application to a parabolic-trough solar-thermal collector is described. Tests were conducted at the Collector Module Test Facility and Performance Prototype Trough Test Facility on a resistance wire-type solar-flux sensor. The device consists of two fine wires installed along each side of the absorber tube parallel to the axis. The wires change resistance as a function of the solar flux arriving at the absorber from the reflectors. The resistance of the two wires is compared to produce a null signal when both wires are equally illuminated. The signal from the wires is used in combination with a microprocessor control system to drive the collectors to the optimum tracking angle. Comparisons are made between the performance of the flux tracker, a computer-based tracker, and a shadow-band tracker.

1420 Heat Storage

12181 **(SERI/STR—231-1812) High-temperature integrated thermal-energy-storage system for solar-thermal applications. Final subcontract report.** Bruckner, A.P.; Hertzberg, A. (Washington Univ., Seattle (USA)). Dec 1982. Contract AC02-77CH00178. 112p. NTIS, PC A06/MF A01. Order Number DE83004755.

An analysis is presented of a novel, very high temperature solar thermal energy storage system which uses molten slag as the storage medium. Slag bead aggregate is melted in a solar central receiver and stored in liquid form at 1650°K in an insulated refractory storage vessel. Sensible heat is extracted from the molten slag in a direct-contact droplet heat exchanger, in which the slag is sprayed as a multitude of droplets through a high pressure counterflowing working gas. The heated gas is used in a high-temperature regenerative Brayton cycle. The solidified slag droplets are returned to the solar receiver to repeat the cycle. Capital cost and present worth revenue requirement data are developed from a 10 MW/sub e/ point-design electric power system for 1, 6, 15, and 48 hour storage.

15 GEOTHERMAL ENERGY

REFER ALSO TO CITATION(S) 11998

12182 **(DOE/GET—83/1) Geothermal Energy Technology: a current-awareness bulletin.** Smith, L.B. (ed.). (Department of Energy, Oak Ridge, TN (USA). Technical Information Center). 15 Jan 1983. 21p. NTIS. Order Number DE83002686.

Portions of document are illegible. Available on a subscription basis at $40.00 per volume (calendar) year.

This bulletin announces on a semimonthly basis the current worldwide information available on the technology required for economic recovery of geothermal energy and its use either directly or for production of electric power. The subject content encompasses: resource status and assessment, geology and hydrology of geothermal systems, geothermal exploration, legal and institutional aspects, economic and final aspects, environmental aspects and waste disposal, by-products, geothermal power plants, geothermal engineering, direct energy utilization, and geothermal data and theory.

12183 **(TENRAC/EDF—045) Texas geothermal R D & D program planning support document. Final report.** Davis, R.J.; Conover, M.F.; Keeney, R.C.; Personett, M.L.; Richmann, D.L. (Radian Corp., Austin, TX (USA)). 28 Aug 1981. 270p. NTIS, PC A12/MF A01. Order Number DE83900796.

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Program planning support was provided by; developing a geothermal RD and D program structure, characterizing the status of geothermal RD and D through review of literature and interaction with the geothermal research community, developing a candidate list of future Texas geothermal projects, and prioritizing the candidate projects based on appropriate evaluation criteria. The method used to perform this study and the results thereof are presented. Summary reviews of selected completed and ongoing projects and summary descriptions and evaluations of the candidate RD and D projects ar provided. A brief discussion emerging federal RD and D policies is presented. References and independent project rankings by three of the GRP members are included. (MHR)

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 12230, 12231, 12232, 12233, 12235, 12236

12184 (CONF-811250—, pp 64p, Section 11) **Opportunities for industry in the development of geothermal energy at US military installations.** Austin, C.F.; Whelan, J.A. (Naval Weapons Center, China Lake, CA). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

The Air Force has completed a study of the geothermal potential of USAF bases. The power generation potential, space or industrial heating potential, and geopressure potential at each USAF base are discussed in detail. The data available for those USAF bases which exhibit the greatest potential for use of geothermal energy are listed. Bases with significant potential that are discussed in detail include: Mountain Home (space heating), Saylor Creek Range at Mountain Home (power), Ellsworth Air Force Bases (space heating); Keesler Air Force Base (geopressurized geothermal resource), Hill Air Force Base (space heating), and William Air Force Base (power) in the Continental United States and Bellows Air Force Base, Hawaii (power), Lajes Air Force Base, Azores (power), and Ankora Air Station, Turkey (space heating) outside of the Continental United States. Open literature and unpublished field studies provided the basis for evaluation.

12185 **(DOE/RA/50076—1) Potential of utilization of geothermal energy in Arizona. Executive summary.** White, D.H.; Goldstone, L.A. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). Aug 1982. Contract FC03-80RA50076. 61p. NTIS, PC A04/MF A01. Order Number DE83004875.

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Arizona is one of the fastest growing states in the United States. It is in the midst of the movement of the population of the United States from its cold regions to the warm Southwest. Being a hot, arid region, its electrical demand is nearly 50% higher in the peak hot summer months than that of the other seven months. The major uncertainty of utilizing geothermal energy in Arizona is that very little exploration and development have occurred to date. The potential is good, based on (a) the fact that there are over 3000 thermal wells in Arizona out of a total of about 30,000 shallow (less than 1000 ft) irrigation wells. In addition, there is much young volcanic rock in the State of Arizona. The combination of data from thermal wells, young volcanic rock, water geochemistry and other geological tools, indicate that there is a large geothermal resource throughout the southern half of the state. It is believed that most of this resource is in the range of 50°C (122°F) to 150°C (302°F), limiting its uses to direct heat utilization rather than for electric power generation.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 12237, 12250, 12253, 13198, 13199, 13205

12186 **(DOE/NV/10194—1) Analysis of three geopressured geothermal aquifer-natural gas fields; Duson Hollywood and Church Point, Louisiana.** Rogers, L.A.; Boardman, C.R. (GeoEnergy Corp., Las Vegas, NV (USA)). May 1981. Contract AC08-81NV10194. 40p. NTIS (US Sales Only). Order Number DE83004777.

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The available well logs, production records and geological structure maps were analyzed for the Hollywood, Duson, and Church Point, Louisiana oil and gas field to determine the areal extent of the sealed geopressured blocks and to identify which aquifer sands within the blocks are connected to commercial production of hydrocarbons. The analysis showed that over the depth intervals of the geopressured zones shown on the logs essentially all of the sands of any substantial thickness had gas production from them somewhere or other in the fault block. It is therefore expected that the sands which are fully brine saturated in many of the wells are the water drive portion of the producing gas/oil somewhere else within the fault block. In this study only one deep sand was identified, in the Hollywood field, which was not connected to a producing horizon somewhere else in the field. Estimates of the reservoir parameters were made and a hypothetical production calculation showed the probable production to be less than 10,000 b/d. The required gas price to profitably produce this gas is well above the current market price.

12187 **(USGS-PP—1141) Research in the Geysers-Clear Lake geothermal area, northern California.** McLaughlin, R.J.; Donnelly-Nolan, J.M. (eds.). (Geological Survey, Washington, DC (USA)). 1981. 257p. GPO.

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Twenty-four papers are included. A separate abstract was prepared for each one. (MHR)

12188 (USGS-PP—1141, pp 3-23) **Tectonic setting of pre-tertiary rocks and its relation to geothermal resources in the Geysers-Clear Lake area.** McLaughlin, R.J. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

The Geysers-Clear Lake geothermal area lies within the central belt of the Franciscan assemblage in northern California. The structure of this terrane is characterized by northeast-dipping imbricate thrust slices that have been warped and cut by steeply dipping strike-slip and normal faults. Introduction of magma into the crust beneath the Geysers-Clear Lake area can be related to east-southeast extension accompanying northward propagation of the San Andreas transform system between the Clear Lake region and Cape Mendocino within the last 3 million years. The initiation of strike-slip faulting during this time terminated subduction of elements of the Farallon plate beneath North America as strike-slip motion was taken up along the Pacific-North American plate boundary. The mechanism for magma generation appears to require a heat source in the mantle that mixed mantle-derived melts with various crustal rocks. These crustal rocks may have included the Franciscan central and coastal belts, ophiolite, Great Valley sequence, and possibly middle and late Tertiary rocks subducted before initiation of strike-slip faulting. The Geysers steam reservoir is on the northeast limb of a major southeast-plunging antiform in late Mesozoic rocks of the Franciscan assemblage. The reservoir also coincides with the southwest side of a major negative gravity anomaly interpreted to delineate the presence of magma within the upper crust. The most significant factors limiting the extent of the steam reservoir seem to be the distribution of heat and open-fracture networks, the presence of cap rocks that retain fluid in the reservoir rocks, and the presence of areas of adequate hydrothermal leakage that allow the system to remain vapor-dominated.

12189 (USGS-PP—1141, pp 25-45) **Clear Lake Volcanics: tectonic setting and magma sources.** Hearn, B.C. Jr.; Donnelly-Nolan, J.M.; Goff, F.E. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

The Clear Lake Volcanics may be the latest surface manifestation of a mantle hot spot that has left a track of Tertiary and Quaternary volcanic centers in the California Coast Ranges. These centers are progressively older to the south and are anomalously close to the former position of the subduction zone between the North American and Farallon crustal plates. Although initiation of volcanism may be correlated with cessation of subduction, problems of geometry and heat transfer probably preclude magma genesis from the newly detached slab of oceanic crust. One or more predecessors of an inferred shallow magma chamber have been located beneath the central part of the field since about 0.6 m.y. ago, and perhaps since 1.1 m.y. ago. The current chamber is the ultimate source of heat for the vapor-dominated geothermal system at The Geysers and the inferred hot-water geothermal system beneath the volcanic field. Geophysical studies locate the magma chamber in Franciscan rocks and underlying crustal rocks of oceanic and possible continental affinity. Strontium isotopes, major and trace elements, and seismic velocities indicate that basaltic magmas have been generated from several mantle sources which probably consist of pyroxenite, peridotite, and eclogite. The many lavas, which as a group show a complete range of composition from basalt to rhyolite, are the products of fractional crystallization, wallrock assimilation, and magma mixing which have affected the primary melts from the mantle.

12190 (USGS-PP—1141, pp 47-60) **Geochronology and evolution of the Clear Lake Volcanics.** Donnelly-Nolan, J.M.; Hearn, B.C. Jr.; Curtis, G.H.; Drake, R.E. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

The Clear Lake Volcanics covers approximately 400 km^2 in the northern California Coast Ranges. Seventy-three potassium-argon ages established the age range of the lavas as from 2.1 m.y. to 10,000 yr B.P. The K-Ar ages were especially important for isolated units and sequences and have been essential to understanding the evolution of the magmatic system in time and space. In a general way, the Clear Lake Volcanics is younger to the north, as are other Tertiary volcanic rocks along the length of the California Coast Ranges. The dates strongly suggest the existence of three time breaks in the volcanic sequence, and possibly a fourth. Each break covered a period of about 0.2 m.y. in which no known volcanic eruptions took place. The earliest and most recent periods of volcanism were dominated by basaltic eruptions. The greatest volume of lava was erupted during the period from 0.6 to 0.3 m.y. ago, when about 35 cubic kilometers of dacite built Mount Konocti, which represents more than a third of the total volume of the volcanic field.

12191 (USGS-PP—1141, pp 61-66) **Strontium isotopes in the Clear Lake Volcanics.** Futa, K.; Hedge, C.E.; Hearn, B.C. Jr.; Donnelly-Nolan, J.M. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

The complex array of $^{87}Sr/^{86}Sr$ values, when combined with Rb, Sr, and rare-earth concentration data, provides insight into the processes of magma genesis and evolution of the Clear Lake Volcanics. Some of the oldest and some of the youngest basalts and basaltic andesites are quite primitive, both in terms of $^{87}Sr/^{86}Sr$ ratios (0.7032) and Rb and Sr concentrations. These rocks are almost certainly mantle derived. The other basaltic andesites, which have higher $^{87}Sr/^{86}Sr$ ratios and less primitive geochemical characteristics than the more primitive basalts, were derived from a different source. Rhyolites tend to have high $^{87}Sr/^{86}Sr$ ratios (0.7040 to 0.7055), and other evidence is indicative of fractional crystallization of feldspar. Overall, the $^{87}Sr/^{86}Sr$ ratio increases with decreasing Sr content and increasing SiO_2 content. In many of the rhyolites and dacites the feldspar phenocrysts are more or less out of equilibrium with their host lavas in terms of both $^{87}Sr/^{86}Sr$ ratios and Sr concentrations. The data suggest that numerous magmas were generated from at least two different sources. These magmas then probably fractionally crystallized in crustal-level magma chambers, interacted extensively with their wallrocks, and in some cases mixed with other magma batches.

12192 (USGS-PP—1141, pp 67-82) **Paleomagnetism of the Clear Lake Volcanics and new limits on the age of the Jaramillo normal-polarity event.** Mankinen, E.A.; Donnelly-Nolan, J.M.; Gromme, C.S.; Hearn, B.C. Jr. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Paleomagnetic studies and potassium-argon age determinations on rocks from the Clear Lake volcanic field, California, have provided additional information on the limits of the Jaramillo normal-polarity event. Several flows record part of the polarity transition at the end of the event. Reversed-polarity flows that provide a limit to the older boundary of this event have also been found. Detailed K-Ar dating of these flows, when combined with data from other localities, shows that the Jaramillo event lasted from 0.97 to 0.90 m.y. ago, an age that is in excellent agreement with estimates made from deep-sea sediment cores and mid-oceanic magnetic anomalies. VGP (virtual geomagnetic pole) positions calculated from intermediate-polarity lavas from Clear Lake fall very close to the published VGP path for the Matuyama-Brunhes polarity transition recorded in sediments from Lake Tecopa, California. Recurrence of similar VGP positions during at least three polarity reversals over a time span of 500,000 years suggests that transitional VGP paths may be controlled by some long-term regional features.

12193 (USGS-PP—1141, pp 129-137) **Seismicity of the Geysers-Clear Lake region.** Bufe, C.G.; Marks, S.M.; Lester, F.W.; Ludwin, R.S.; Stickney, M.C. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Microearthquake activity in the Geysers-Clear Lake region has been monitored continuously since 1975. The seismogenic zone across the geothermal area and gravity low is relatively shallow; earthquake focal depths are generally less than 5 km. The absence of deeper earthquakes is consistent with the hypothesis of elevated temperatures associated with a magma body at depth. The present average tectonic-stress orientation, deduced from P-wave first motions, indicates maximum compression at N. 20° E. and minimum compression at N. 70°W. over most of the region. This stress orientation is rotated approximately 20° clockwise from that producing maximum right-lateral shear on faults subparallel to the San Andreas fault, possibly accounting for the diffuse pattern of epicenters in the region. Most fault-plane solutions suggest right-lateral strike-slip motion on short, possibly echelon faults trending more northerly than the geologically well defined Maacama and Collayomi fault systems. Most of the earthquakes in the geothermal region occur in two clusters at The Geysers. Earthquakes in the steam-production area and in the surrounding region are characterized by an unusually large number of small earthquakes (high b values). The present seismicity at The Geysers is essentially continuous, in contrast to the episodic nature of earthquake activity in the surrounding region. The spatial distribution of earthquakes with regard to the producing steam field and the continuous nature of earthquake activity strongly suggest that much of The Geysers' seismicity is induced. In late September 1977, the deep pattern of faulting at The Geysers changed from predominantly strike-slip to predominantly normal faulting, indicating a decrease in northeasterly tectonic compression.

12194 (USGS-PP—1141, pp 219-230) **Late Pleistocene stratigraphy and palynology of Clear Lake.** Sims, J.D.; Adam, D.P.; Rymer, M.J. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Eight continuous cores, from 13.9 to 115.2 m long, taken from the lake sediments were predominantly open-water sapropelic mud similar to the mud currently accumulating in Clear Lake. Also present in the lake sediments are a wedge of sandy and gravelly deltaic sediment, from the southern part of the main basin, shallow-water peat and peaty mud that underlie sapropelic mud in the two arms of the lake, and thin volcanic ash beds that are present in all but one of the cores. Radiocarbon dates of peat beds and carbonaceous sediments in core 7, from the southeast-trending arm (Highlands Arm) permit the estimation of ages for ash beds and seismotectonic and paleoclimatic events for approximately the last 40,000 years. Chronologic control for core 4 from the main basin of the lake, the other core of major concern in this report, is based on correlations of its ash beds and pollen curves with their radiometrically dated counterparts in core 7. Other Clear Lake cores also contain radiometrically dated horizons, but they have not been analyzed for pollen. Analyses of pollen from cores 4 and 7 show repeated abrupt changes between high abundance of oak (Quercus) and high abundance of pine (Pinus) pollen, where oak and pine vary inversely with each other. These changes are interpreted as due to fluctuations in the elevation distribution of oak in the hills surrounding Clear Lake in response to changes in climate. Therefore, the oak-pollen curve from Clear Lake may be considered as an uncalibrated paleoclimatic curve, which strongly resembles curves of deep-sea ^{18}O content in foraminifers, and dates the oldest sediment recovered in the Clear Lake cores at approximately 130,000 years old.

12195 (USGS-PP—1141, pp 231-235) **Pliocene and Pleistocene fishes from the Clear Lake area.** Casteel, R.W. (Simon Fraser Univ., Burnaby, British Columbia); Rymer, M.J. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

The remains of six genera of fossil fish were found in the Cache, Lower Lake, and Kelseyville Formations in Lake County, California. The fishes range in age from late Pliocene to late Pleistocene. These remains include the first fossil occurrence of Tule perch, which is the second embiotocid genus known from the late Pliocene freshwater record of California. Our findings add three

new fish genera to the taxa known from the Cache, Lower Lake, and Kelseyville Formations and suggest lacustrine environments like present-day Clear Lake. The presence of the fossil fishes suggests increased precipitation and runoff during deposition of the upper part of the Pleistocene Kelseyville Formation.

12196 (USGS-PP—1141, pp 243-250) **Faulting and ore controls at the Culver-Baer mine, Sonoma County, California.** Ciancanelli, E.V. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

The Culver-Baer mercury mine is located in the Mayacmas quicksilver district on the northwest-trending Mercuryville fault zone, a part of the San Andreas fault system. A zone of hydrothermal alteration occurs along the strike of the Mercuryville fault zone, which was the principal conduit for hydrothermal ore fluids in this area. The hydrothermal fluids selectively altered large blocks of serpentinite to silica-carbonate rock, the host rock for the mercury mineralization. Within the fault zone the serpentinite and silica-carbonate rock are faulted into large blocks surrounded by fault gouge. The fault gouge consists of mylonitized shale enclosing sheared and brecciated blocks of hydrothermally altered graywacke. The regional and local structural relations suggest right-lateral displacement of the faulted blocks of serpentinite and silica-carbonate rock within the Mercuryville fault zone. The variation in location and the specific type of hydrothermal alteration indicate that hydrothermal alteration occurred in three stages at the Culver-Baer mine. Specific structures such as rolls along fault planes, fault intersections, and tension fractures were permeable zones for the circulation of hydrothermal fluids and structurally favorable sites for mercury mineralization.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 12187, 12191, 13213

12197 (DOE/ET/27217—2-Vol.1) **Geopressured-geothermal well report. Volume I. Drilling and completion.** (Technadril - Fenix and Scisson, Houston, TX (USA)). Jan 1982. Contract AC08-80ET27217. 184p. NTIS (US Sales Only). Order Number DE83005095.

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Gladys McCall site activities are covered through the completion of the test well and salt water disposal well. The test well was drilled to a total depth of 16,510 feet, then plugged back to 15,831 feet. Three 4" diameter diamond cores were taken for analysis. An existing well on site, the Getty-Butts Gladys McCall No. 1, was reentered and completed to a depth of 3514 feet as a salt water disposal well. The geologic interpretation of the Gladys McCall site indicated target sands for testing at 15,080 feet through 15, 831 feet. Reservoir fluid temperature at this depth is estimated to be approximately 313°F and pressure is estimated to be +-12,800 psi. The preliminary reservoir volume estimate is 3.6 billion barrels of brine. The design wells program includes environmental monitoring of the Gladys McCall site by Louisiana State University. Field stations are set up to monitor surface and ground water quality, subsidence, land loss and shoreline erosion, and seismicity. As of December 31, 1981 the study shows no significant impact on the environment by site operations.

12198 (DOE/ID/12030—T3) **Evaluation of hydrothermal resources of North Dakota. Phase III final technical report.** Harris, K.L.; Howell, F.L.; Wartman, B.L.; Anderson, S.B. (North Dakota Univ., Grand Forks (USA). Engineering Experiment Station). Aug 1982. Contract FC07-79ID12030. 209p. NTIS, PC A10/MF A01. Order Number DE83004641.

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The hydrothermal resources of North Dakota were evaluated. This evaluation was based on existing data on file with the North Dakota Geological Survey (NDGS) and other state and federal agencies, and field and laboratory studies conducted. The principal sources of data used during the study were WELLFILE, the computer library of oil and gas well data developed during the Phase I study, and WATERCAT, a computer library system of water well data assembled during the Phase II study. A field survey of the shallow geothermal gradients present in selected groundwater observation holes was conducted. Laboratory determinations of the thermal conductivity of core samples were done to facilitate heat-flow calculations on those holes-of-convenience cased.

12199 (DOE/ID/12065—T1) **Cerro Prieto geothermal field: exploration during exploitation.** (International Engineering Co., Inc., San Francisco, CA (USA)). Jul 1982. Contract FC07-79ID12065. 166p. NTIS, PC A08/MF A01. Order Number DE83003448.

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Geological investigations at Momotombo included photogeology, field mapping, binocular microscope examination of cuttings, and drillhole correlations. Among the geophysical techniques used to investigate the field sub-structure were: Schlumberger and electromagnetic soundings, dipole mapping and audio-magnetotelluric surveys, gravity and magnetic measurements, frequency domain soundings, self-potential surveys, and subsurface temperature determinations. The geochemical program analyzed the thermal fluids of the surface and in the wells. The description and results of exploration methods used during the investigative stages of the Momotombo Geothermal Field are presented. A conceptual model of the geothermal field was drawn from the information available at each exploration phase. The exploration methods have been evaluated with respect to their contributions to the understanding of the field and their utilization in planning further development.

12200 (DOE/NV/10194—3) **Screening of three proposed DOE geopressured-geothermal aquifer natural gas project areas for potential conflicting commercial production: Freshwater Bayou, Lake Theriot, and Kaplan, Louisiana.** Knutson, C.F.; Rogers, L.A. (GeoEnergy Corp., Las Vegas, NV (USA)). Feb 1982. Contract AC08-81NV10194. 30p. NTIS, PC A03/MF A01. Order Number DE83004785.

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Three proposed DOE geopressured geothermal prospects defined by the Louisiana State University resource assessment group were screened for possible conflict with existing gas production. The analysis used the public records available at the Louisiana Department of Conservation offices in Baton Rouge and structural and statigraphic interpretations made by the L.S.U. resource assessment group. (MHR)

12201 (LBL—15073) **Repetitive precision gravity studies at the Cerro Prieto and Heber geothermal fields.** Grannell, R.B. (California State Univ., Long Beach (USA). Dept. of Geological Scienes). Sep 1982. Contract AC03-76SF00098. 104p. NTIS, PC A06/MF A01. Order Number DE83004467.

To study subsidence and mass removal, a precise gravity network was established on 60 permanent monuments in the Cerro Prieto geothermal field in early 1978, and repeated annually through early 1981; the survey was tied to two bedrock sites outside the limits of the current production zone. The looping technique of station occupation was utilized, in which occupation of the base was followed by occupation of several stations, followed by a return to the base. Use of two LaCoste and Romberg gravity meters, and replication of values within loops as well as entire loops, enhanced precision such that the median standard deviations of the base-to-station differences, reduced to observed gravity values, ranged from 7 to 15 microgals for individual surveys. The smaller values were obtained as field and data reduction techniques were improved and experience was gained. A similar survey was initiated in the Heber area just north of the Mexican border in early 1980. It too was established on permanent monuments, was tied to bedrock stations outside the geothermal area, and used multiple repetitions of values with two meters to achieve high precision.

12202 (UCRL—87802-Rev.1) **Airborne-temperature-survey maps of heat-flow anomalies for exploration geology.** Del Grande, N.K. (Lawrence Livermore National Lab., CA (USA)). 10 Nov 1982. Contract W-7405-ENG-48. 14p. (CONF-821204—1-Rev.1). NTIS, PC A02/MF A01. Order Number DE83003018.

From International symposium on remote sensing of environment; Ft Worth, TX, USA (6 Dec 1982).

Portions of document are illegible.

Precise airborne temperature surveys depicted small predawn surface temperature differences related to heat flow anomalies at the Long Valley, California, KGRA. Zones with conductive heat flow differences of 45 +- 16 μcal/cm^2(s) has predawn surface temperature differences of 1.4 +- 0.3°C. The warmer zones had hot water circulating in a shallow (less than 60-m-deep) aquifer. Hot water is a useful geochemical indicator of geothermal and mineral resource potential. The precise airborne temperature survey method recorded redundant infrared scanner signals at two wavelengths (10 to 12 μm and 4.5 to 5.5 μm) and two elevations (0.3 km and 1.2 km). Ground thermistor probes recorded air and soil temperatures during the survey overflights. Radiometric temperatures were corrected for air-path and reflected-sky-radiation effects. Corrected temperatures were displayed in image form with color-coded maps which depicted 0.24°C temperature differences. After accounting for surficial features on the corrected predawn thermal imagery, there remained several anomalous zones. These zones had high temperature gradients at depths from 6 to 30 m, compared to the temperature gradients in nearby areas.

12203 (USGS-PP—1141, pp 83-95) **Geophysical overview of The Geysers.** Isherwood, W.F. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Geophysical evidence in and near The Geysers can support inferences about (1) the heat source, (2) the reservoir structure, (3) geologic structure not related to the geothermal reservoir, and (4) current changes taking place in the region. Gravity studies provided the first geophysical indication of a magma chamber in the middle crust beneath the Clear Lake Volcanics. Subsequent results of interpretation of magnetic data, teleseismic P-wave delay data, and heat-flow data appear to substantiate this model of the geothermal heat source. The Geysers steam zone appears to correlate with a residual gravity low and possibly with an anomaly of pseudogravity derived from aeromagnetic data. If there is a productive hot-water zone, it may be delineated by an electrical resistivity low and shallow temperature gradients. Geophysical data can help in estimating the thickness of surface volcanic rocks, the location of feeder vent areas, the location of the Great Valley sequence beneath the volcanic field, and the size of the ultramafic body along the Collayomi fault zone. Temporal changes include subsidence and horizontal movements, reservoir deletion, and associated changes in the stress field. These can be monitored by accurate geodetic measurements and by microearthquake activity. Changes are related to both regional tectonics and fluid withdrawal. Decreasing gravity detected between 1974 and 1977 probably results from the lack of recharge to the reservoir. Interpretation suggests that the dominant mechanism of depletion involves flashing of liquid water in the reservoir in response to production.

12204 (USGS-PP—1141, pp 97-116) **Large teleseismic P-wave delays in the Geysers-Clear Lake geothermal area.** Iyer, H.M.; Oppenheimer, D.H.; Hitchcock, T.; Roloff, J.N.; Coakley, J.M. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

In order to see if a magma chamber is present and, if so, to delineate its shape and physical properties, teleseisms recorded by 26 telemetered and 12 portable seismic stations were examined. Severe signal-shape changes and large teleseismic delays were observed at stations located on the volcanic field centered at Mount Hannah and at the geothermal production zone at The Geysers. For teleseisms in the southwest azimuth, the average delays were 1.5 seconds at Mount Hannah, 0.9 s at Siegler Mountain, and 1.0 s at Black Oaks in the steam production zone. For events in the other azimuths, the delays were less by as much as 0.5 s though still considered quite significant. The spatial distribution outlines a broad region of 0.5-s delay centered at Mount Hannah and extending into the production zone to the southwest, with large delays exceeding 1 s near The Geysers and at Mount Hannah. Results of a seismic-refraction survey in the region show that the delays cannot be attributed to anomalous velocities associated with the complex geologic structure near the surface, and hence a deep low-velocity body in the upper crust is required to explain their presence. A simple modeling technique involving computation of the length of anomalous ray paths is used to determine the size of the low-velocity body. The results show that a plausible model is one in which the low-velocity body about 10 km thick with compressional velocity lower than normal by 15% extends under the young Clear Lake volcanic field and the steam-production zone. The body also has a deep core underlying Mount Hannah and part of the production zone in which the velocity decrease is about 25%. It is believed that this low-velocity body is composed of partially molten rock under the volcanic zone and fractured steam-filled rock with or without an underlying magmatic body under the production area.

12205 (USGS-PP—1141, pp 117-128) **Seismic-reflection investigations at Castle Rock Springs in the Geysers geothermal area.** Denlinger, R.P.; Kovach, R.L. (Stanford University, CA). 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Seismic-reflection profiling verifies the presence of an anticlinal trap in the vicinity of the Castle Rock Springs steam field. Strong reflection amplitudes recorded near the crest of the anticline correlate in depth with an observed fracture zone in a nearby well, and strong reflections within the core of the anticline may also be due to the fracture zones from which steam is produced in this area. Southwest of the anticline, a band of seismic energy may indicate the contact between fractured graywacke reservoir rock and its mafic caprock. The seismic sections also indicate southeast and northeast extensions of the cap which could not be inferred on the basis of previous information. A strong deep reflection which we believe represented a tectonic boundary in the Fransiscan assemblage was recorded below 4 km. This boundary dips northeastward toward a possible heat source and occurs at depths between the heat source and the steam system.

12206 (USGS-PP—1141, pp 149-160) **Attenuation of teleseismic P waves in the Geysers-Clear Lake region.** Young, C.Y.; Ward, R.W. (Texas Univ., Dallas). 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

During July and September 1976, the US Geological Survey deployed 14 portable short-period seismographs along a line trending roughly northwest-southeast between Clear Lake and The Geysers to study traveltime delays of teleseismic P waves associated with magma or partially molten zones beneath the geothermal system. The P waves of 22 teleseismic events, suitable for attenuation analysis, were recorded by 13 seismographs. The events were digitized and spectrally analyzed using both periodograms and the maximum entropy method (MEM). Seismograms exhibited both a significant drop in amplitude and waveform broadening. The location and extent of the zones of high attenuation were qualitatively inferred from the power-density spectra of the seismograms. The reduced spectral ratio technique was applied to determine the differential attenuation factor δt^* quantitatively, assuming that the quality factor Q is independent of frequency. The maximum differential attenuation is about 0.3 s, which roughly corresponds to a 5-km-thick zone with Q equal to 25 embedded in a high-Q medium. The lateral variation of δt^* was used to infer the Q structure in the frequency range 0.25 to 2.5 Hz, assuming that the teleseismic wave propagating to each station is identical when it enters the bottom of the crust-upper mantle model. A shallow zone of high attenuation extends from the Geysers steam field an undetermined distance toward the northeast and is 15 km wide. The zone of high attenuation deepens to the northwest between stations CL07 and CL08 and toward the southeast near station CL05. The thickest part is probably located beneath station CL06 or Mount Hannah and possibly station CL12, where the zone is very close to the surface.

12207 (USGS-PP—1141, pp 161-166) **Detailed gravity survey of the Wilbur Springs area, California.** Harrington, J.M.; Verosub, K.L. (Univ. of California, Davis). 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Quicksilver deposits, hot springs, and exploratory geothermal drilling demonstrate the existence of a thermal anomaly in the Wilbur Springs area, 18 km east of Clear Lake. In addition, the trend of volcanic activity in the Geysers-Clear Lake region indicates that Wilbur Springs may be the site of future activity. In an attempt to determine the source of the thermal anomaly, a detailed gravity survey was conducted in an area corresponding to the Wilbur Springs SW.7 1/2-minute quadrangle. Complete Bouguer anomalies were computed based on reduction densities of 2.67 g/cm^3 and 2.50 g/cm^3. After removal of a regional gradient, two features of significance emerged from the data. The first is a gravity high apparently associated with the presence of mafic or ultramafic material. The other is a gravity low that can be interpreted as a manifestation of a very shallow geothermal reservoir located in the southeast part of the study area.

12208 (USGS-PP—1141, pp 167-181) **Seismic-refraction measurements of crustal structure near Santa Rosa and Ukiah, California.** Warren, D.H. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Seismic recordings were made in September 1976 along two 150-km profiles subparallel to regional northwest-southeast strike-slip faults. One profile extends from near Fairfield in a northwest direction to the vicinity of Willits, and the other extends from Novato northwest to a point about 20 km southeast of Mendocino. Shots were fired at five locations, and recordings were made by truck-mounted and portable recording systems and by some stations of the Geological Survey's central California microearthquake network. P-wave first arrivals recorded on the three types of seismographs were used to determine straight-line segmented traveltime curves. The near-surface velocity ranges from 2.0 to 4.2 km/s in a layer whose thickness ranges from 0.2 to 1.7 km but averages 1 km. Below this layer, seismic basement velocity is about 5.0 to 5.3 km/s in a layer of thickness averaging about 2 km on the northeast line and about 6 km on the southwest line. Underneath, the crustal velocity is about 5.9 km/s. From one shotpoint on the southwest line an apparent velocity of 7.2 km/s was observed for a refractor about 15 km deep. Some prominent later arrivals on the line to the southwest can be interpreted as reflections from the top of the mantle. They suggest a crustal thickness of 20 km and a mean crustal velocity of 5.8 to 5.9 km/s.

12209 (USGS-PP—1141, pp 183-191) **Chemical analyses of waters from springs and wells in the Clear Lake volcanic area.** Thompson, J.M.; Goff, F.E.; Donnelly-Nolan, J.M. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Water samples of springs were collected as close to the main orifice of each spring as possible. Well waters were collected by pumping or discharging water from the well, if possible, or by dropping a weighted bottle attached to a long line. Water samples of streams and lakes were collected at convenient points (docks, piers, and so on). All samples must be considered grab samples. No integrated samples from Clear Lake or any major stream or creek were obtained. Temperature measurements of springs and wells were made with either a total-immersion maximum-reading mercury-in-glass thermometer or with a conventional mercury-in-glass thermometer. Springs having temperatures near that of ambient air temperature required the use of the latter thermometer. Field determinations were usually made for pH either with a pH electrode or pH strips (colorpHast, EM Laboratories, Inc.), depending upon accessibility of the spring or stream location.

12210 (USGS-PP—1141, pp 193-203) **Variability and sources of hydrogen sulfide and other gases in steam at The Geysers.** Brook, C.A. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Hydrogen sulfide is a common constituent of fluids from vapor-dominated geothermal systems throughout the world. In steam at The Geysers, hydrogen sulfide is the second or third most abundant noncondensable gas (after carbon dioxide and methane). Measured hydrogen sulfide concentrations range from less than 0.001 percent to about 0.1 percent by weight of the total steam discharge from individual wells; concentrations of other gases also range by one or two orders of magnitude. Data from wells in the southern part of the Geysers steam field suggest that gas concentrations in individual steam entries are highly variable, both laterally and vertically. The variability in gas contents is apparently unsystematic and is not related to depth, wallrock temperature, gas-to-steam ratio, or location in the steam field. Three possible sources of hydrogen sulfide in hydrothermal fluids include (1) magmatic exhalation, (2) water-rock reactions (hydrolysis) and (3) thermal metamorphism. Thermal degradation of organic material, especially plant tissue, is favored as the source of much of the hydrogen sulfide at The Geysers. The fracture system in the Geysers reservoir is complex, and fluid passing through fractures in organic-bearing rocks probably is enriched in noncondensable gases including hydrogen sulfide, carbon dioxide, methane, and ammonia. An initial or primary gas-concentration variability can thus be imparted locally to the fluid. Variations in gas concentrations may be secondarily augmented by mixing or by steam condensation and gas enrichment in cooler parts of the reservoir.

12211 (USGS-PP—1141, pp 205-209) **Gases from springs and wells in the Geysers-Clear Lake area.** Nehring, N.L. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Major gases and trace hydrocarbon gases were analyzed from nine springs and one well in and near the Clear Lake volcanic field and from three wells in the Geysers steam field. The Clear Lake samples generally contained 93 to 100 percent CO_2, 0.1 to 6 percent CH_4, and small amounts of H_2; all samples showed some air contamination of probable near-surface origin. Similar patterns in the C/sub 1-6/ hydrocarbon gases indicate a similar origin in sedimentary rocks and a similar history. The Geysers samples contained 90 to 98 percent CO_2, 0.5 to 2.5 percent H_2S, and lesser amounts of N_2, Ar, CH_4, and H_2. The hydrocarbon patterns suggest an origin similar to that of gases in the Clear Lake area but a somewhat different history. No evidence was found for a magmatic source of gases.

12212 (USGS-PP—1141, pp 211-213) **Carbon-13 isotope values for carbon dioxide gas and dissolved carbon species in springs and wells in the Geysers-Clear Lake region.** Huebner, M. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Water and gas samples from wells and springs in the Geysers-Clear Lake region have $\delta^{13}C$ values of -11.8 to -19.9 permil for CO_2 (gas) and -9.3 to -11.6 permil for dissolved carbon species. Because $\delta^{13}C$ values from the steam field are more depleted than those in the adjacent hot-water field, carbon dioxide from a deep rock source is probably mixing with carbon dioxide of meteoric origin in the region above the hot-water field. Fractionation between CO_2 (gas) and dissolved carbon species (mainly HCO_3^-) indicate near-equilibrium at measured surface temperatures; however, the data do not agree with reservoir temperatures indicated by chemical geothermometers. The carbon species and the CO_2 (gas) probably reequilibrated during movement of the fluid from the reservoir to the surface.

12213 (USGS-PP—1141, pp 215-218) **Chemical composition of water and gas from five nearshore subaqueous springs in Clear Lake.** Thompson, J.M.; Sims, J.D.; Yadav, S.; Rymer, M.J. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Gas and water samples can easily be collected from shallow submerged springs by using a peristaltic battery-powered pump. Qualitatively, sulfate, ammonia, chloride, and lithium concentrations may be used to estimate the amount of lake-water contamination. Our deep gas sampling technique, which uses an inverted

funnel and long tube to the surface, was employed only where visibility was greater than 2 to 3 m. Analyses of gas samples collected just under the lake surface compared to samples collected near the lake bottom indicates air contamination in the near-surface samples. Thus, gas samples should be collected deep underwater or as near the spring vent or gas orifice as possible.

12214 (USGS-PP—1141, pp 237-241) **Mercury in the sediments of Clear Lake.** Sims, J.D.; White, D.E. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Two cores 21.6 and 6 m long were taken in Clear Lake 3.5 and 1.2 km east-northeast of the Sulphur Bank mercury mine, respectively. Sediments in the cores are mostly bioturbated olive-gray sapropelic mud. The longer core contains interbedded peat, carbonaceous sediments, and ash beds between 7.6 and 21.6 m depth. Six zones of peat and carbonaceous sediments have been ^{14}C dated and the ash beds correlated with ^{14}C-dated ash beds in a core 2.5 km to the south. The mercury content of the sediments in the longer core is much higher than the local background (0.4 parts per million or less), ranging from 0.4 to 75 ppM. The lowest values are generally below 13 m, and the highest value is at the top of the core. Above 13 m depth, the mercury content varies between 1 and 65 ppM and averages 12.1 ppM. Below 13 m (about 17,500 B.P.), the mercury content of the sediments varies between 0.4 and 9.2 ppM (at 21 m) and averages 1.4 ppM. Carbon-14 dates in this core and correlations with ash beds dated in other nearby cores indicate irregular episodes of a high rate of supply of Hg, reaching peak levels at about 34,000, 23,300, 18,000, 9,500, 7,400, and 3,600 B.P. Andesite at Sulphur Bank mine is mineralized with cinnabar and is ^{14}C dated at younger than 44,500 +- 800 B.P. Present-day high values (75 ppM) of Hg are interpreted to be related to mining activity. Older high values are attributed to the flow of Hg-bearing fluids, which, although variable, were probably continuous; Hg not deposited in the Sulphur-Bank ore body presumably passed into Clear Lake and was adsorbed on organic material by mechanisms not fully understood.

12215 (DOE/ET/27204—T1-Vol.2-App.Sect.1) **Assessment of the geothermal resources of Kansas. Volume II. Appendices. Final report.** Steeples, D.W.; Stavnes, S.A. (eds.). (Kansas Geological Survey, Lawrence (USA)). Jun 1982. Contract AS07-79ET27204. 60p. NTIS, PC A04. Order Number DE83003220.

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The following appendices are included: technical data on logging apparatus, logging method - top-down versus bottom-up, and temperature profiles of thermal logging data. (MHR)

12216 **Geothermal resource exploration.** Wollenberg, H.A. (Lawrence Berkeley Lab., CA). *Geological Society of America, Special Paper;* No. 189, 375-386(1982). (CONF-790284—). Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

Exploration for geothermal resources in the Basin and Range geomorphic province of the western United States is much akin to mineral resource exploration. In this region, potential geothermal resources are located at or near zones of intersection of normal faults, where fracture permeability permits deep circulation of meteoric water into high-temperature areas afforded by high regional heat flow. Exploration encompasses regional surveys, covering several thousand square kilometres, followed by more detailed studies of several hundred square kilometres to identify sites for deep drillholes. The most effective methods for regional exploration are geologic studies based on areal multispectral surveys, heat-flow drilling, chemical geothermometry of warm- and cold-water sources, and age-dating of rock. Detailed heat-flow-hydrologic surveys, gravity and active-seismic surveys, and geologic mapping are most effective in locating targets for deep confirmatory drilling. Geochemical-halo surveys may also be very effective in both regional and areal exploration. Results of geochemical, radiochemical, and geophysical surveys combine to furnish a comparison of long-term flow rates of geothermal systems, thereby permitting preliminary evaluation of the relative viability of the systems.

1504 Legal And Institutional Aspects

12217 (CONF-811250—) **Geothermal energy: the institutional maze and its changing structure.** (Geothermal Resources Council, Davis, CA (USA)). 1981. 650p. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

Thirteen papers are included. A separate abstract was prepared for each one. (MHR)

12218 (CONF-811250—, pp 17p, Section 1) **Attitudes of the Reagan Administration toward geothermal development.** Russell, D.C. (Dept. of the Interior, Washington, DC). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

The attitudes of the Reagan Administration toward geothermal leasing and development are discussed with emphasis on regulatory reform, administrative actions, and support legislation. Included in appendices are memos from the Secretary of the Interior and the Director of the Bureau of Land Management on the Geothermal Leasing Program.

12219 (CONF-811250—, pp 5p, Section 2) **Streamlining internal administrative procedures for geothermal development at the US Geological Survey, US Bureau of Land Management and the US Forest Service.** Isherwood, W.; Holt, B. (Geological Survey, Menlo Park, CA). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

The roles of the three principal agencies for lease issuance and administration and the highlights of recent changes in federal requirements for submittal of plans and reports by operators are discussed. A summary of the details of a new Memorandum of Understanding (MOU) which governs inter-agency coordination between the three major actors in the federal lease program is included. The new MOU contains procedures for streamlining paper work.

12220 (CONF-811250—, pp 5p, Section 3) **Legal and institutional overview: by land and air - the struggle continues.** McNamara, J.J. (J.M. Energy Consultants, Inc., Los Angeles, CA). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

The changes in policy brought about by the Reagan administration relative to geothermal leasing and the Clean Air Act are discussed.

12221 (CONF-811250—, pp 17p, Section 4) **Pending changes in the regulation of solid waste disposal and underground injection: impact of state programs in lieu of federal programs.** Knight, G.D. (US Synthetic Fuels Corp., Washington, DC). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

The regulatory regimes emanating from the Resource Conservation and Recovery Act and the Underground Injection Control regulations pursuant to the Safe Drinking Water Act are discussed. The EPA budget cutbacks and their effects on the states are described.

12222 (CONF-811250—, pp 22p, Section 5) **Federal legislation affecting geothermal development.** Bliss, R.W. 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

Critical points in the existing federal leasing law are reviewed in order to point up the need for amendment. The following are discussed: the Geothermal Steam Act of 1970, early efforts to amend the Geothermal Steam Act, the Public Utilities Regulatory Policies Act, pending federal leasing legislation, protection of thermal features of national parks, the Clausen amendment, federal tax incentives for geothermal, and the federal legislative future.

12223 (CONF-811250—, pp 10p, Section 7) **PURPA benefits for geothermal power producers: assured markets and regulatory exemptions.** Nimmons, J.T. (Earl Warren Legal Inst., Berkeley, CA). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

Important economic and regulatory benefits now available to independent geothermal power producers under Title II of the Public Utilities Regulatory Policies Act of 1978 are reviewed. The extension of certain of these benefits to utility owned geothermal facilities under recent regulations implementing the 1980 Energy Security Acts' amendments to PURPA is discussed.

12224 (CONF-811250—, pp 8p, Section 8) **District heating: legal, institutional, and public relations aspects.** King, D. 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

Geothermal district heating and ways of developing such systems are described. Financing, legal authority, public utility regulation, and public support are discussed.

12225 (CONF-811250—, pp 231p, Section 9) **Implications of the California Public Utilities Commission's decision on the proposed Southern California Edison/Chevron Resources Power Plant at Heber, California.** Grew, P.C. (California Public Utilities Commission, San Francisco). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

The implications of the decision on Edison's Heber proposal are discussed. The decision test is included. The Commission decided against the proposal since the electricity costs were not competitive with existing alternatives and placed an undue burden on ratepayers. The Commission's Order Instituting Rulemaking No. 2 reviewing and establishing standards governing the prices, terms, and conditions of utility purchases of electricity from qualifying facilities is appended to this paper.

12226 (CONF-811250—, pp 19p, Section 12) **Special requirements and procedures for geothermal development on Navy lands.** Austin, C. (Naval Weapons Center, China Lake, CA). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

Lease constraints for the Coso leases are attached. The constraints on the contractor at Coso are presented. Examples of other constraints intended to cover special conditions which can be expected at other Naval Installations are included. The instruction used for industrial access to the Coso area prior to the lease sale so that industry would have a chance to look the area over is given.

12227 (CONF-811250—, pp 216p, Section 13) **Laws and regulations governing procurement.** Ladd, T.A. 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

A knowledge of the statutes and functions concerning procurement is essential for all personnel performing functions in the Government contracting field. A brief outline of how these laws and regulations came to be developed is provided. The DOD approach to the development of energy sources on military lands is discussed. The following are presented: two-step formal advertising, proposal preparation, and producing and selling energy. Three booklets are included: Selling to the Military, Selling to Navy Prime Contractors, and How to be Considered for NAVFAC Contracts.

12228 (CONF-811250—, pp 4p, Section 14) **Geothermal development on military lands: US Navy contract regulations from a developer's point of view.** Roney, D.M. Jr. (California Energy Co., Inc., Santa Rosa). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

The additional constraints on contractors working on Naval lands are listed and discussed briefly.

12229 (DOE/NV/10194—2) **Evaluation of land ownership, lease status, and surface features in five geopressured geothermal prospects.** Hackenbracht, W.N. (CK GeoEnergy Corp., Las Vegas, NV (USA)). May 1981. Contract AC08-81NV10194. 62p. NTIS (US Sales Only). Order Number DE83004776.

Mf only; illegibility does not permit PC reproduction.

This study was accomplished for the purpose of gathering information pertaining to land and lease ownership, surface features and use and relevant environmental factors in the Lake Theriot (West and East), Kaplan, Bayou Hebert and Freshwater Bayou geopressured geothermal prospects in Louisiana, and the Blessing geopressured geothermal prospect in Texas. This information and recommendations predicated upon it will then be used to augment engineering and geological data utilized to select geopressured geothermal test well sites within the prospects. The five geopressured geothermal prospects are briefly described and recommendations given.

1505 Economic And Financial Aspects

REFER ALSO TO CITATION(S) 12185

12230 (DOE/RA/50076—2) **Geothermal development plan: Maricopa County.** White, D.H.; Goldstone, L.A. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). Aug 1982. Contract FC03-80RA50076. 80p. NTIS, PC A05/MF A01. Order Number DE83004876.

The Maricopa County Geothermal Development Plan evaluated the market potential for utilizing geothermal energy. The study identified six potential geothermal resource areas with temperatures less than 100°C (212°F) and in addition, four suspected intermediate temperature areas (90° to 150°C, 194° to 300°F). Geothermal resources are found to occur in and near the Phoenix metropolitan area where average population growth rates of two to three percent per year are expected over the next 40 years. Rapid growth in the manufacturing, trade and service sectors of the regional economy provides opportunities for the direct utilization of geothermal energy. A regional energy use analysis is included containing energy use and price projections. Water supplies are found to be adequate to support this growth, though agricultural water use is expected to diminish. The study also contains a detailed section matching geothermal resources to potential users. Two comparative analyses providing economic details for space heating projects are incorporated.

12231 (DOE/RA/50076—3) **Geothermal development plan: Pima County.** White, D.H.; Goldstone, L.A. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). Aug 1982. Contract FC03-80RA50076. 63p. NTIS, PC A04/MF A01. Order Number DE83004877.

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The Pima County Area Development evaluated the county-wide market potential for utilizing geothermal energy. The study identified four potential geothermal resource areas with temperatures less than 100°C (212°F), and in addition, one area is identified as having a temperature of 147°F (297°F). Geothermal resources are found to occur in Tucson where average population growth rates of two to three percent per year are expected over the next 40 years. Rapid growth in the manufacturing sector and the existence of major copper mines provide opportunities for the direct utilization of geothermal energy. However, available water supplies are identified as a major constraint to projected growth. The study also includes a regional energy analysis, future predictions for energy consumption and energy prices. A major section of the report is aimed at identifying potential geothermal users in Pima County and providing projections of maximum economic geothermal utilization. The study identifies 115 firms in 32 industrial classes that have some potential for geothermal use. In addition, 26 agribusiness firms were found in the county.

12232 **(DOE/RA/50076—4) Geothermal development plan: northern Arizona counties.** White, D.H.; Goldstone, L.A. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). Aug 1982. Contract FC03-80RA50076. 75p. NTIS, PC A05/MF A01. Order Number DE83004878.

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The Northern Counties Area Development Plan evaluated the regional market potential for utilizing geothermal energy. This study identified five potential geothermal resource areas, four of which have low temperature (<90°C, 194°F) potential and one possible igneous system. The average population growth rate in the Northern Counties is expected to be five percent per year over the next 40 years, with Mohave and Yavapai Counties growing the fastest. Rapid growth is anticipated in all major employment sectors, including trade, service, manufacturing, mining and utilities. A regional energy use analysis is included, containing information on current energy use patterns for all user classes. Water supplies are expected to be adequate for expected growth generally, though Yavapai and Gila Counties will experience water deficiencies. A preliminary district heating analysis is included for the towns of Alpine and Springerville. Both communities are believed located on geothermal resource sites. The study also contains a section identifying potential geothermal resource users in northern Arizona.

12233 **(DOE/RA/50076—5) Geothermal development plan: Pinal County.** White, D.H.; Goldstone, L.A. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). Aug 1982. Contract FC03-80RA50076. 43p. NTIS, PC A03/MF A01. Order Number DE83004879.

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The Pinal County Area Development Plan evaluated the county-wide market potential for utilizing geothermal energy. The study identified three suspected geothermal resource areas with potential 70°C (158°F) temperatures. In addition, one geothermal test well near Coolidge encountered bottom hole temperatures of 120°C (248°F) at a depth of 2440 m (8005 ft) and produced 18.3 l/sec (290 gpm). Geothermal resources are found to occur near population centers where average growth rates of 1.5% to 2% per year are expected over the next 40 years. Mining, agriculture and manufacturing are all important sectors of the regional economy and provide opportunities for direct utilization of geothermal energy. A regional energy use analysis includes energy use projections and regional energy price information. Agriculture accounts for 95% of the annual water consumption and predicted decreases in water availability will result in less future agricultural activity. The analysis contains a detailed section matching geothermal resources to potential industrial users. Fourteen firms in 10 industrial classes were identified as having some potential for geothermal energy use. In addition, 25 agricultural firms were identified as having some potential for geothermal use, including the prepared feeds industry.

12234 **(DOE/RA/50076—6) Geothermal development plan: Cochise/Santa Cruz Counties.** White, D.H.; Goldstone, L.A. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). Aug 1982. Contract FC03-80RA50076. 49p. NTIS, PC A03/MF A01. Order Number DE83004880.

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The Cochise/Santa Cruz Counties Area Development Plan evaluated the regional market potential for utilizing geothermal energy. The study identified three potential geothermal resource areas with potential for resource temperatures less than 90°C (194°F). Geothermal resources are found to occur near the towns of Willcox, San Simon, and Bowier. Population growth rates are expected to average three percent per year over the next 30 years in Willcox; Bowie and San Simon are expected to grow much slower. Regional employment is based on agriculture and copper mining, though future growth in trade, services and international trade is expected. A regional energy-use analysis is also included. Urban use, copper mining and agriculture are the principal water users in the region and substantial reductions in water use are anticipated in the future. The development plan also contains a section identifying potential geothermal energy users in the region. Geothermal energy utilization projections suggest that by the year 2000, geothermal energy might economically provide the energy equivalent of 3,250,000 barrels of oil per year to the industrial sector. In addition, geothermal energy utilization might help stimulate an agricultural and livestock processing industry.

12235 **(DOE/RA/50076—7) Geothermal development plan: Yuma County.** White, D.H.; Goldstone, L.A. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). Aug 1982. Contract FC03-80RA50076. 41p. NTIS, PC A03/MF A01. Order Number DE83004882.

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The Yuma County Area Development Plan evaluated the county-wide market potential for utilizing geothermal energy. The study identified four potential geothermal resource areas with temperatures less than 90°C (194°F), and in addition, two areas are inferred to contain geothermal resources with intermediate (90°C to 150°C, 194°F to 300°F) temperature potential. The resource areas are isolated, although one resource area is located near Yuma, Arizona. One resource site is inferred to contain a hot dry rock resource. Anticipated population growth in the county is expected to be 2 percent per year over the next 40 years. The primary employment sector is agriculture, though some light industry is located in the county. Water supplies are found to be adequate to support future growth without advese affect on agriculture. Six firms were found in Yuma County which may be able to utilize geothermal energy for process heat needs. In addition, several agricultural processors were found, concentrated in citrus processing and livestock raising. Geothermal energy utilization projections suggest that by the year 2000, geothermal energy may economically provide the energy equivalent of 53,000 barrels of oil per year to the industrial sector if developed privately. Geothermal utilization projections increase to 132,000 barrels of oil per year by 2000 if a municipal utility developed the resource.

12236 **(DOE/RA/50076—8) Geothermal development plan: Graham/Greenlee Counties.** White, D.H.; Goldstone, L.A. (Arizona Univ., Tucson (USA). Dept. of Chemical Engineering). Aug 1982. Contract FC03-80RA50076. 56p. NTIS, PC A04/MF A01. Order Number DE83004881.

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The Graham/Greenlee County Area Development Plan evaluated the region-wide market potential for utilizing geothermal energy. The study identified five potential geothermal resource areas with temperatures less than 100°C (212°F). In addition, seven areas are inferred to contain higher temperature resources with the Clifton Hot Springs area having electrical potential. Geothermal resources are found to occur near Safford and Clifton, the two major population centers. Future population growth in the two counties is expected to average less than two percent per year over the next 40 years. Growth in the mining, trade and services economic sectors provide opportunities for the direct utilization of geothermal energy. A regional energy use analysis is included containing energy use and price projections. Water supplies are found to be adequate for urban needs, though agricultural and mineral water use may be limited in the future. The study also contains a preliminary economic analysis for two district heating systems as well as a section matching geothermal resources to potential users.

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 12210, 13201

12237 (USGS-PP—1141, pp 139-148) **Monitoring crustal deformation in the Geysers-Clear Lake region.** Lofgren, B.E. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

Geodetic surveys from 1973 to 1977 reveal significant crustal deformation in the Geysers-Clear Lake region. Resurveys of precise control networks are measuring both vertical and horizontal ground movement, mostly in the area of geothermal fluid withdrawal. Preliminary evidence suggests right-lateral horizontal movement on northwest-trending fault systems and vertical and horizontal compression of the deep geothermal reservoir system. A direct correlation is suggested between ground-surface deformation and subsurface pressure changes in the reservoir system. Although surface changes appear too small to be of environmental concern in the Geysers-Clear Lake region, they indicate significant hydrodynamic changes in the reservoir. Two types of vertical changes at The Geysers are indicated in the 1973 to 1977 data: a regional subsidence between the Collayomi and Mercuryville fault zones and local subsidence directly related to the area of principal steam production. Maximum subsidence of 13 cm in 4 1/2 years occurred in the area of most concentrated steam withdrawals and where fluid-pressure declines were near maximum. Subsidence rates throughout the production area from 1973 to 1975 were about half the 1975 to 1977 rates, in apparent correlation with pressure changes measured in the reservoir system. Horizontal ground movement as great as 2.0 cm per year, generally inward toward the center of production, was measured around the perimeter of the steam production area.

12238 **Prediction of chemical problems in the reinjection of geothermal brines.** Weres, O.; Apps, J.A. (Lawrence Berkeley Lab., CA). *Geological Society of America, Special Paper;* No. 189, 407-426(1982). (CONF-790284—). Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

Amorphous silica and silicates, and the carbonates and sulfates of calcium, strontium, and barium are the solids most commonly deposited by geothermal brines. The phenomenology and kinetics of their precipitation are reviewed. Practical methods of avoiding or reducing reinjection well damage are discussed, with emphasis on the important and well-researched problem of removing colloidal amorphous silica from spent geothermal brines before reinjection. Need for further research is also discussed. It is concluded that the interaction of the reinjected brine with the reservoir rock and the brine's effect on rock properties are the areas that most need further research.

1508 Geothermal Power Plants

12239 (CONF-811250—, pp 10p, Section 10) **SCE resources in the 1980's.** Nola, S.J. (Southern California Edison, Rosemead). 1981. Geothermal Resources Council, P.O. Box 98, Davis, CA 95617.

From Conference on geothermal energy: the institutional maze and its changing structure; Newport Beach, CA, USA (1 Dec 1981).

Southern California Edison's business environment, resource strategy, and geothermal program are described. The future of conventional, renewable, and alternative resources is discussed.

12240 **(DOE/ER/10614—2) Tests of a two-stage, axial-flow, two-phase turbine.** Elliott, D.G. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Dec 1982. Contract AI01-80ER10614. 34p. (JPL-PUB—82-98). NTIS, PC A03/MF A01. Order Number DE83005138.

A two-phase-flow turbine with two stages of axial-flow impulse rotors was tested with three different working-fluid mixtures at a shaft power of 30 kW. The turbine efficiency was 0.55 with nitrogen-and-water of 0.02 quality and 94 m/s velocity, 0.57 with Refrigerant 22 of 0.27 quality and 123 m/s velocity, and 0.30 with steam-and-water of 0.27 quality and 457 m/s velocity. The efficiencies with nitrogen-and-water and Refrigerant 22 were 86% of theoretical. At that fraction of theoretical, the efficiencies of optimized two-phase turbines would be in the low 60% range with organic working fluids and in the mid 50% range with steam-and-water. The recommended turbine design is a two-stage axial-flow impulse turbine followed by a rotary separator for discharge of separate liquid and gas streams and recovery of liquid pressure.

12241 **(ORNL/TM—8494) Condensation of Refrigerant-11 on the outside of horizontal and inclined enhanced tubes.** Domingo, N. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 140p. NTIS, PC A07/MF A01. Order Number DE83004721.

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Heat transfer condensation tests with Refrigerant-11 were performed on the outside of a smooth tube and a variety of enhanced tubes oriented horizontally and at various tube inclinations. One smooth tube and seven enhanced (externally fluted, roped, spiraled, and externally finned) tubes of 2.54-cm (1-in.) nominal outside diameter and 1.17-m (4-ft) length were tested. Several of the tested tubes featured internal enhanced geometries, which were caused by the heat transfer enhancing geometry on the tube's external surface. Condensing heat transfer coefficients are reported as composite coefficients, which combine the resistance of the condensing film and the tube wall, and are based on total tube outside surface area. Results show that in the horizontal condensing mode, the rank order (best to worst) of the tube geometries tested was spiral-shaped tubes, rope-shaped tubes, smooth tube, externally finned tube, and externally fluted tube. For a spiral-shaped tube, horizontal composite coefficients were up to 2.0 times the corresponding horizontal smooth tube values. For tilt angles $\geq 60^{\circ}$ from the horizontal, the condensing performance of the externally fluted tube was best of all the tubes tested.

1509 Geothermal Engineering

REFER ALSO TO CITATION(S) 13203, 13204

12242 **(DOE/AL/10563—T15) Hydraulic fracture stimulation treatment of Well Baca 23. Geothermal Reservoir Well-Stimulation Program.** (Republic Geothermal, Inc., Santa Fe Springs, CA (USA); Maurer Engineering, Inc., Houston, TX (USA); Vetter Research, Costa Mesa, CA (USA)). Jun 1981. Contract AC04-79AL10563. 82p. NTIS, PC A05/MF A01. Order Number DE83003858.

Well Stimulation Experiment No. 5 of the Geothermal Reservoir Well Stimulation Program (GRWSP) was performed on March 22, 1981 in Baca 23, located in Union's Redondo Creek Project Area in Sandoval County, New Mexico. The treatment selected was a large hydraulic fracture job designed specifically for, and utilizing frac materials chosen for, the high temperature geothermal environment. The well selection, fracture treatment, experiment evaluation, and summary of the job costs are presented herein.

12243 **(DOE/AL/10563—T16) Acidification of geothermal wells: Laboratory experiments. Geothermal Reservoir Well-Stimulation program.** (Vetter Research, Costa Mesa, CA (USA)). Jan 1982. Contract AC04-79AL10563. 49p. NTIS, PC A04/MF A01. Order Number DE83003838.

The laboratory testing of the reactions of acetic, formic, hydrochloric, and hydrofluoric acids with calcium carbonate, kaolin, sepiolite, and two formation materials at geothermal temperatures is described. A workable test procedure was developed which provided information regarding the relative reactivities of selected minerals or formation materials with three of the four acids investigated. Tests with hydrochloric acid were complicated by reactions of the acid with the test vessel materials and therefore, only very limited work could be done with this acid at the desired temperatures. In spite of these difficulties, information regarding the amount of soluble material in the various acids was obtained. From this information an approximate value for the percent dissolution of the minerals under the different reaction conditions could be calcu-

lated. Additional information regarding the formation of solid secondary reaction products upon cooling of the reacted acid was also obtained. The implication of the mineral reactivities with the different acids and the formation of secondary solids on geothermal acidizing operations are discussed. Some selected scale inhibitors (for calcium carbonate) were tested for their hydrothermal stability. Their efficiency in inhibiting the formation of calcium carbonate scale before and after aging at 500°F was measured. The implications of the loss of efficiency of these materials and recommendations for their use in the field are discussed.

12244 **(DOE/ET/27217—1) Gladys McCall geopressured design well. Annual progress report, October 1, 1980-September 30, 1981. T-F and S/DOE Gladys McMcall No. 1 well, Cameron Parish, Louisiana.** (Technadril - Fenix and Scisson, Houston, TX (USA)). 1981. Contract AC08-80ET27217. 26p. NTIS, PC A03/MF A01. Order Number DE83005096.

Portions of document are illegible. Printed copy available until stock is exhausted.

The following aspects of the geopressured design well program are described: administration, control systems, financial summary, procurement, sites, significant problems, and future plans. (MHR)

12245 **(LA-UR—82-3584) Los Alamos hot-dry-rock project: recent results.** Brown, D.W. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 7p. (CONF-821214—2). NTIS, PC A02/MF A01. Order Number DE83004808.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

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A new deeper reservoir is presently being investigated at the Laboratory's Fenton Hill Hot Dry Rock (HDR) site. The region surrounding the lower of two inclined boreholes, directionally-drilled to about 4 km in hot crystalline rock, has been pressurized in a sequence of injection tests. Based primarily on the measurements made by two close-in microseismic detectors, two similar volumetric reservoir regions have been developed by massive hydraulic fracturing, but with no significant hydraulic communication with the upper borehole as yet.

12246 **(LA-UR—82-3682) Unique aspects of drilling and completing hot-dry-rock geothermal wells.** Carden, R.S.; Nicholson, R.W.; Pettitt, R.A.; Rowley, J.C. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. 32p. (CONF-830203—1). NTIS, PC A03/MF A01. Order Number DE83004812.

From IADC/SPE drilling conference; New Orleans, LA, USA (20 Feb 1983).

Drilling operations at the Fenton Hill Hot Dry Rock (HDR) Geothermal Test Site have led to numerous developments needed to solve the problems caused by a very harsh downhole environment. A pair of deep wells were drilled to approximately 15,000 ft (4.6 km); formation temperatures were in excess of 600°F (300°C). The wells were directionally drilled, inclined at 35°, one above the other, in a direction orthogonal to the least principal stress field. The well site is near the flank of a young silicic composite volcano in the Jemez Mountains of northern New Mexico. The completion of this pair of wells is unique in reservoir development. The lower well was planned as a cold water injector which will be cooled by the introduced water from the static geothermal gradient to about 80°F (25°C). The upper well will be heated during production to over 500°F (250°C). The well pair is designed to perform as a closed loop heat-extraction system connected by hydraulic fractures with a vertical spacing of 1200 ft between the wells. These conditions strongly constrain the drilling technique, casing design, cement formulation, and cementing operations.

12247 **(SAND—81-2124) Geothermal technology development program. Annual progress report, October 1980-September 1981.** Kelsey, J.R. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Sep 1982. Contract AC04-76DP00789. 526p. NTIS, PC A23/MF A01. Order Number DE83005378.

The status of ongoing Research and Development (R and D) within the Geothermal Technology Development Program is described. The program emphasizes research in rock penetration mechanics, fluid technology, borehole mechanics, and diagnostics technology.

12248 **(SAND—82-2377) Final report - Magma Energy Research Project.** Colp, J.L. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 34p. NTIS, PC A02/MF A01. Order Number DE83004761.

Scientific feasibility was demonstrated for the concept of magma energy extraction. The US magma resource is estimated at 50,000 to 500,000 quads of energy - a 700- to 7000-yr supply at the current US total energy use rate of 75 quads per year. Existing geophysical exploration systems are believed capable of locating and defining magma bodies and were demonstrated over a known shallow buried molten-rock body. Drilling rigs that can drill to the depths required to tap magma are currently available and experimental boreholes were drilled well into buried molten rock at temperatures up to 1100°C. Engineering materials compatible with the buried magma environment are available and their performances were demonstrated in analog laboratory experiments. Studies show that energy can be extracted at attractive rates from magma resources in all petrologic compositions and physical configurations. Downhole heat extraction equipment was designed, built, and demonstrated successfully in buried molten rock and in the very hot margins surrounding it. Two methods of generating gaseous fuels in the high-temperature magmatic environment - generation of H_2 by the interaction of water with the ferrous iron and H_2, CH_4, and CO generation by the conversion of water-biomass mixtures - have been investigated and show promise.

12249 **(SAND—82-7037) Clay-based geothermal drilling fluids.** Guven, N.; Carney, L.L.; Lee, L.J.; Bernhard, R.P. (Texas Tech Univ., Lubbock (USA). Dept. of Geosciences). Nov 1982. Contract AC04-76DP00789. 181p. NTIS, PC A09/MF A01. Order Number DE83005198.

The rheological properties of fluids based on fibrous clays such as sepiolite and attapulgite have been systematically examined under conditions similar to those of geothermal wells, i.e. at elevated temperatures and pressures in environments with concentrated brines. Attapulgite- and sepiolite-based fluids have been autoclaved at temperatures in the range from 70 to 800°F with the addition of chlorides and hydroxides of Na, K, Ca, and Mg. The rheological properties (apparent and plastic viscosity, fluid loss, gel strength, yield point, and cake thickness) of the autoclaved fluids have been studied and correlated with the chemical and physical changes that occur in the clay minerals during the autoclaving process.

12250 **Physics of flow in geothermal systems.** Pinder, G.F.; Shapiro, A. (Princeton Univ., NJ). *Geological Society of America, Special Paper;* No. 189, 25-30(1982). (CONF-790284—). Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

The equations governing the simultaneous flow of steam and water in a geothermal reservoir are developed by treating the porous medium as a continuum. The balance laws for mass, linear momentum, and energy, which are valid for a single continuum, are integrated over each phase (rock, liquid water, and steam) in a representative elementary volume of the medium. The resulting equations are macroscopic point balances, which account entirely for the loss of definition in going from the microscopic to the macroscopic level of observation.

12251 **Instrumentation for well tests.** Schroeder, R.C. (Lawrence Berkely Lab., CA). *Geological Society of America, Special Paper;* No. 189, 199-206(1982). (CONF-790284—). Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

The types and uses of well tests in the disciplines of hydrology, petroleum engineering, and geothermal engineering are reviewed. Geologic and economic factors that influence the design of well tests are summarized along with the difficulties of designing tests for each category of applications. The types of data needed

for hydrothermal tests are discussed in detail, and the problems commonly encountered when taking measurements under various operating conditions are reviewed. A historical review of well-testing instruments includes information on some of the latest equipment advances in the field. The ideal instrument array for well testing would measure pressure, temperature, flow rate, enthalpy, and concentration simultaneously and at several locations. The accuracy and durability limits of commercially available equipment are evaluated against this ideal according to the properties the equipment measures. Finally, the instruments that come closest to meeting the standards of well log analysts are identified.

12252 **Treatment methods for geothermal brines.** Phillips, S.L. (Lawrence Berkeley Lab., CA); Mathur, A.K.; Garrison, W. *American Society for Testing and Materials, Special Technical Publication;* No. 717, 207-224(1981). Contract W-7405-ENG-48.

A survey is made of commercially available methods currently in use, as well as those which might be used, to prevent scaling and corrosion in geothermal brines. More emphasis is placed on scaling than on corrosion. Treatments are classified as inhibitors, alterants, and coagulants and are applied to control scaling and corrosion in fresh and waste geothermal brines. Recommendations for research in brine treatment are described.

1510 Direct Energy Utilization

REFER ALSO TO CITATION(S) 12056

1520 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 12187, 13202, 13203

12253 (USGS-PP—1141, pp 251-259) **Preliminary investigation of accessory zircons from volcanic and sedimentary rocks from Clear Lake.** Wilson, F.A. 1981. GPO.

In Research in the Geysers-Clear Lake geothermal area, northern California.

A preliminary study was made of zircons from five samples of sedimentary and volcanic rocks from the Clear Lake volcanic field. The distributions of crystal types, size, degree of idiomorphism, and inclusions for each sample population were compared graphically and statistically. The Franciscan assemblage and the Great Valley sequence underlie the volcanic field. Samples of Franciscan metagraywacke and Great Valley sandstone yield similar tan-colored zircon concentrates composed of colorless individual zircons that fluoresce. The two concentrates, however, have different size distributions. The andesite of Perini Hill yielded a pale-pink zircon concentrate made up of colorless, pale-pink, and pink zircons. Part of a large schistose xenolith from this andesite contains similar zircons, but many xenolith zircons show substantial overgrowths, and the size distribution is similar to that of the Franciscan sample. The pink zircon concentrate from a younger, coarsely porphyritic dacite of Horseshoe Bend contains pink, inclusion-filled, mainly euhedral zircons with a broad distribution of three crystal types that differ markedly from the other samples.

12254 **Carbonate equilibria in hydrothermal systems: first ionization of carbonic acid in NaCl media to 300°C.** Patterson, C.S.; Slocum, G.H.; Busey, R.H.; Mesmer, R.E. (Oak Ridge National Lab., TN). *Geochimica et Cosmochimica Acta;* 46: No. 9, 1653-1663(Sep 1982). Contract W-7405-ENG-26.

The ionization quotients of aqueous carbon dioxide (carbonic acid) have been precisly determined in NaCl media to 5 m and from 50° to 300°C using potentiometric apparatus previously developed at Oak Ridge National Laboratory. The pressure coefficient was also determined to 250°C in the same media. These results have been combined with selected information in the literature and modeled in two ways to arrive at the best fits and to derive the thermodynamic parameters for the ionization reaction, including the equilibrium constant, activity coefficient quotients, and pressure coefficients.The variation with temperature of the two fundamental quantities ΔV° and $\Delta C/\text{sub } p/^{\circ}$ were examined along the saturation vapor pressure curve and at constant density. The results demonstrated again that for reactions with minimal electrostriction changes the magnitudes and variations of $\Delta C/\text{sub } p/^{\circ}$ and ΔV° with temperature are small and, in addition, $\Delta C/\text{sub } p/$ and ΔV are approximately independent of salt concentration. The results have also been applied to an examination of the solubility of calcite as a function of pH (in a given NaCl medium) for the neutral to acidic region both for systems with fixed CO_2 pressure and systems where the calcium ion concentration equals the concentration of carbon. The pH of saturated solutions of calcite with $P/\text{sub } CO_2/$ of 12 bars increases from 5.1 to 5.5 between 100° and 300°.

12255 **Porous rock-fluid systems at elevated temperatures and pressures.** Somerton, W.H. (Univ. of California, Berkeley). *Geological Society of America, Special Paper;* No. 189, 183-197(1982). (CONF-790284—). Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

The effects of elevated temperatures and pressures on the physical properties of porous rock-fluid systems are received and analyzed. It is well known that the physical properties of rock vary considerably depending on the magnitude and history of the stresses, pore fluid pressures, and temperatures to which the rocks are subjected as well as the type and amount of fluid saturation. The review shows that the available data are limited and sometimes contradictory. Although general trends have been established, these need to be quantified for use in subsurface performance calculations. It has been concluded that three major problems need to be solved before appropriate values for the subsurface environment may be assigned. The first of these is how to simulate subsurface stress and temperature conditions in laboratory measurements. The second is the need to correlate the physical properties required in reservoir-performance analysis and log interpretation with some simpler properties of the rock-fluid system. All desired properties used in the correlation should be measured concurrently on the same test specimen and under identical test conditions. The third need is to develop models that will make it possible to predict physical properties and behavior of rocks from easily determined characteristics of the rock-fluid system. Examples of successful modeling of the thermal properties and behavior of rocks are presented.

16 Wave Energy Converters

REFER ALSO TO CITATION(S) 12133

17 WIND ENERGY

REFER ALSO TO CITATION(S) 11998

1701 Availability (climatology)

REFER ALSO TO CITATION(S) 11999, 12000, 12001, 12002, 12010, 12011

12256 (CONF-811175—, pp 150) **World-wide wind energy resource assessment.** Elliott, D.L. (Pacific Northwest Lab., Richland, WA); Aspliden, C.I.; Cherry, N.J. Sep 1981. NTIS (US Sales Only), PC A08/MF A01. Contract AC06-76RL01830.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12257 (CONF-811175—, pp 151) **Wind power potential in Israel and the eastern Mediterranean.** Manes, A.; Rindsberger, M.; Segal, L. (Israel Meteorological Service, Bet-Dagan). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12258 (CONF-811175—, pp 152) **Wind measurements for large wind turbines.** Tetzlaff, G. (Universitaet Hannover, Germany). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12259 (PB—82-258971) **An assessment of wind characteristics and wind energy conversion systems for electric utilities.** DeWinkel, C.C. (Wisconsin Univ., Madison (USA). Inst. for Environmental Studies). Jun 1982. 175p. NTIS, PC A08/MF A01.

Evaluation of wind speed data from 12 airport sites in Wisconsin, Minnesota, Iowa, and Illinois, and from five Coast Guard stations along Lakes Superior and Michigan, indicates annual average wind speeds of 4.5 to 6 m/s and wind power densities of 100 to 200 W/sq m at 7 m height. The economic analysis of wind energy conversion systems (WECS) applied to the Dairyland Power Cooperative (DPC) system indicates that it can be economically attractive for the DPC to install WECS in the 1980s. This analysis does not include benefits due to the potential replacement of conventional capacity by the WECS. A preliminary study of WECS in combination with directly controlled water heaters shows that this combined system may delay conventional generating capacity additions longer than will controlled heaters only. A detailed reliability and cost production analysis of WECS plus direct control of a variety of loads is required to evaluate these systems accurately.

1705 Environmental Aspects

12260 (SERI/TR—635-1247) **Predictions of low-frequency sound from the MOD-1 wind turbine.** Martinez, R.; Windall, S.E.; Harris, W.L. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Aeronautics and Astronautics). Dec 1982. Contract AC02-77CH00178. 61p. NTIS, PC A04/MF A01. Order Number DE83004410.

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The purpose of this project was to determine if aerodynamic noise mechanisms are associated with the acoustic noise situation that results from the operation of the MOD-1 wind turbine near Boone, NC. Acoustic measurements indicate that sound from the turbine produced structural vibrations in homes near the turbine site. The possible sources of aeroacoustic noise studied were steady blade loads, unsteady blade loads due to wind shear, and unsteady loads on the blades as they pass through the tower wake. Mathematical models that were used to study these noise sources are described. The results showed that the most significant source of impulsive, low-frequency sound was the unsteady loads that occurred when the blade passed through the tower wake. This problem might be resolved by operating the turbine at a lower rotor speed. This issue might also be resolved by changing the structural configuration of the tower to create an azimuthally smoother wake which would dramatically reduce the noise.

1706 Wind Energy Engineering

REFER ALSO TO CITATION(S) 12108, 12258

12261 (AD-A—119389/5) **Operating and maintenance experience with a 6-kW wind energy conversion system at Naval Station, Treasure Island, California. Technical note Sep 79-Jun 81.** Pal, D. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Jul 1982. 55p. NTIS, PC A04/MF A01.

The experience gained and lessons learned from the 6-kW grid-integrated Wind Energy Conversion System (WECS) demonstration at Naval Station, Treasure Island, San Francisco Bay are detailed. The objective of this demonstration was to develop operating experience and maintenance information on the 6-kW WECS using a combination of permanent magnet alternator with a line commutated synchronous inverter. The on-site measurements conducted during the demonstation indicate that the WECS site has annual average windspeeds of about 8 to 10 mph. The test results to data indicate a satisfactory performance of the WECS except for two failures involving arcing at the electrical terminals located on the yaw shaft. Due to wind characteristics encountered at the site, the performance data collected to date are at windspeeds of 20 mph or lower. For evaluating the WECS performance at all windspeeds, location at a windier site with annual average windspeeds of 14 mph or higher is recommended.

12262 (CONF-811175—, pp 13-28) **Technological aspects of wind energy conversion.** Tewari, S.K. (National Aeronautical Lab., Bangalore, India). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

Various technological advances in wind power are briefly presented. Energy conversion concepts are presented, categorized as vertical axis wind turbines, horizontal axis wind turbines, and other concepts including the tornado and flapping vane concepts. The performance effectiveness of various concepts is then presented, based on the power coefficient. The influence of various design parameters on performance is studied. Construction techniques adopted in some of the designs are briefly illustrated, followed by a discussion of regulation and furling mechanisms and some structural dynamics aspects of large wind turbines. Other topics briefly mentioned include: wind loads, siting considerations, array efficiencies, energy pattern factor, wind forecasting, capacity credit, offshore wind power, and economics. (LEW)

12263 (DOE/RA/50292—T1) **Doubly fed machine review: agenda. Conference report, Washington, DC.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). 1 Sep 1982. Contract AC02-81RA50292. 47p. NTIS, PC A03. Order Number DE83002492.

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The visual aids presented at the doubly fed machine review are presented. The doubly fed machine is a generating system either for wind turbines or hydro systems. Conceptual design and tradeoffs are included, as well as testing. (LEW)

12264 (NYSERDA—82-12) **Commercial wind-energy-conversion systems (WECS) monitoring and utility-impacts study. Final report.** (Bronx Frontier Development Corp., NY (USA); Regional Systems Services Group, Inc., Englewood, CO (USA)). Sep 1981. 162p. New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY.

Portions of document are illegible.

Test results and analyses are presented for a commercially available wind energy conversion system (WECS) evaluated in four modes over nearly a two-year period. Focus is on three major areas: (1) comparative testing of the WECS performance in four modes; (2) WECS/utility interface impacts evaluation; and (3) WECS performance and economic evaluations. The same wind turbine generator rotor (at 38'-9" diameter) was utilized for two alternator and two induction mode tests. Of note, synchronous inverter and battery equipment limited performance and power quality of alternator modes, while the induction mode tested well (especially with transmission and power factor correction capacitor modifications). Other topics addressed include practical operations and maintenance experience, testing of selected WECS subsystems, instrumentation and metering.

12265 (TENRAC/EDF—062) **Use of wind power to assist in stripper (oil) well pumping.** Gilmore, E.H. (West Texas State Univ., Canyon (USA). Alternative Energy Inst.). 31 Aug 1981. 32p. NTIS, PC A03/MF A01. Order Number DE83900825.

A wind-electric generator was selected for a wind-assist to stripper (oil) well pumping experiment. The field, containing 100 wells, is northeast of Borger, Texas. The machine is rated at 8 kW in a 20 mph of progress made to August 31, 1981 is presented. The general background and motivating objectives have already been discussed. This list of the objectives and their presentation is the most complete and detailed to date. General features of the UTRC-8 wind turbine are described, and a list of its technical specifications is given. The foundation design and its minor modifications are discussed along with a brief account of the construction. Turbine modifications made by the technician during assembly and just prior to its erection are discussed. Information concerning the erec-

tion of the wind turbine is also provided. A view of the total instrumentation also is given with a description of what has been accomplished. The small amount of data collected within the short time interval between the erection of the machine and the end of the contract period is presented and briefly discussed.

12266 **(TENRAC/EDF—071) Wind-assist irrigation and electrical-power generation. Final report.** Nelson, V.; Starcher, K. (West Texas State Univ., Canyon (USA). Alternative Energy Inst.). 13 Jul 1982. 26p. NTIS, PC A03/MF A01. Order Number DE83900882.

A wind turbine is mechanically connected to an existing irrigation well. The system can be operated in three modes: (1) electric motor driving the water turbine pump. (2) Wind assist mode where wind turbine supplements power from the utility line to drive the water turbine pump. At wind speeds of 12 m/s and greater, the wind turbine can pump water (15 kW) and feed power (10 kW) back into the utility grid at the same time. (3) Electrical generation mode where the water pump is disconnected and all power is fed back to the utility grid. The concept is technically viable as the mechanical connection allows for a smooth transfer of power in parallel with an existing power source. Minor problems caused delays and major problems of two rotor failures precluded enough operation time to obtain a good estimation of the economics. Because reliability and maintenance are difficult problems with prototype or limited production wind energy conversion systems, the expense of the demonstration project has exceeded the estimated cost by a large amount. During the two year period, the wind turbines were operational 1400 hours and generated 2540 kWh of energy. The dollar value of the energy was only $140. Major problems have been experienced with the wind turbine during the entire project. The original prototype lost a blade in October 1979. Another prototype was developed which had a larger diameter and a microprocessor control system at ground level. A Wingen 2 was installed in May 1980; however, problems with its control system prevented shakedown testing until July. In March 1981, another major rotor failure occurred. Instead of repairing the wind turbine, Wind Engineering agreed to install their third generation design, a completely new machine for $5000.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 11621, 11756, 11758, 11765, 12508, 12544

12267 **(BMFT-FB-T—094) Computer simulation of the dynamic behaviour of a coal-fired power plant with pressurized fluidized bed.** Plackmeyer, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1982. 44p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750918.

The insteady behaviour of a coal-fired power plant with pressurized fluidized bed and gas turbine will be investigated. Physical-mathematical models of all single components will be developed or used (as far as they are known) and combined in a total computer program. Starting point of the investigation is the planned pilot-plant with gas turbine of the Arbeitsgemeinschaft Wirbelschichtfeuerung (AGW). Various modifications of the purely air-cooled plant, as well as the extension to a combined cycle with additional steam turbine will be considered. The following operation cases were calculated and described in detail in the unshortened report: starting up, increasing from partial load to full load and vice versa, shutdown and breakdowns. Because of the shortage of space only three significant operating cases are described here: starting up and breakdown of the air-cooled plant and shutdown of the combined plant. The results show that all operating cases could be got under control as well as the breakdowns. The necessary constructions and the suitable kind of operation are described in detail.

12268 (CONF-8108141—, pp 249-256) **Makret place economics and coal conversions.** Davies, R.L. (Dept. of Energy, Washington, DC). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

In summary, conventional coal conversion of fossil fuel power plants is really getting into high gear. About 300 MBD of coal capable plants are on the road to conversion now. Conversion of oil and gas designed plants, a heretofore inconceivable event, is now possible; plants totaling 350 MBD have already been identified as conversion candidates and many utilities are exploring this option. Thus, the likely oil savings figure is already 750 MBD (or 5.4 billion dollars a year fuel cost saving) and is expected to increase.

12269 (CONF-8108141—, pp 294-317) **Application of the Toscoal process to the electric utility industry.** Cortez, D.H.; LaDelfa, C.J. (Tosco Corp., Los Angeles, CA). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The principal objectives of the Toscoal development program are to upgrade coal to increase its heating value and to recover gaseous and liquid products which are more valuable on a Btu basis than the coal feedstock. The coal char produced contains sufficient volatile matter to permit utilization in existing power plants without extensive modification of the facilities or need for significant supplemental fuels. Other potential benefits of the Toscoal process are (1) reduction in coal transportation costs by rail or slurry pipeline, (2) reduction in sulfur emissions from coal-fired power plants, (3) production of a char which may be attractive for gasification by entrained flow or fluid bed processes, and (4) production of char for manufacture of formed coke from non-metallurgical grade coals. This paper presents the results of recent feasibility studies of the Toscoal process for recovering oil and gas from Utah coal prior to combustion in power plants. To establish realistic costs for a marketable liquid product, a hydrotreating unit was integrated with the basic Toscoal unit. The hydrotreater converts the raw coal liquid into a lighter syncrude product which is low in sulfur, nitrogen and other impurities. In general, the economics of coal pyrolysis are improved for coals with a high volatile matter content, low moisture and sulfur content and low swelling tendency. Since the Utah bituminous coals meet these criteria, a typical Utah coal was selected for evaluation as a Toscoal feedstock. Table 1 contains the feedstock design basis.

12270 **(DOE/EIS—0083-F) Final Northeast Regional Environmental Impact Statement: potential conversion of forty-two powerplants from oil to coal or alternate fuels.** (USDOE Economic Regulatory Administration, Washington, DC. Office of Fuels Programs). Oct 1982. 420p. NTIS (US Sales Only). Order Number DE83003847.

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This final environmental impact statement (FEIS) assesses the potential for cumulative and interactive impacts resulting from the conversion of 42 powerplants in the Northeastern United States from oil to coal and from a more likely Voluntary Conversion scenario of 27 powerplants. The FEIS is designed to provide decisionmakers with information on the types and magnitude of environmental impacts associated with a range of conversion scenarios within the coal alternative. These scenarios are defined in terms of the air pollution emission limitations that could be imposed on a particular facility by a state or federal agency as a condition for conversion to coal. The substantive areas of environmental impact that are analyzed are: air quality, water quality, land use, biotic resources, socioeconomics, and health effects. In addition to coal burning, the potential environmental impacts associated with conservation, and with the solar, wind, hydroelectric, coal-fired cogeneration, wood, and geothermal alternatives are assessed. This document together with the draft environmental impact statement (DEIS) constitute USDOE's Final Northeast Regional Environmental Impact Statement.

12271 **(DOE/RG/10076—T1) Engineering analysis for Albany Power Plant. Final report.** (Automated Management Systems, Lanham, MD (USA)). May 1980. Contract AC01-79RG10076. 31p. NTIS, PC A03/MF A01. Order Number DE83001913.

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This report is a review of the present facilities of Niagara Mohawk Power Corporation's Albany Power Plant. This review was undertaken in order to determine the feasibility of reconverting the four existing oil-burning electric power units to coal-burning ones. As part of this review, site visits were made and conferences were held with plant operating personnel and Department of Energy (DOE) officials to determine what plant alterations were needed to conform to applicable codes and present-day environmental requirements. In light of the technical evaluations, the recommended selected course of action, based on cost and physical suitability for the station, is proposed. The potential total project cost is estimated as $83.221 million with the project duration estimated to be between 2.5 to 3.5 years.

12272 (GFETC/IC—82/1, pp 142-161) **Design for lignite firing at the San Miguel Power Plant.** Haller, K.H. (Babcock and Wilcox Co., Barberton, OH). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The increasing demand for low sulfur coal and the diminishing availability of oil and natural gas for electric power generation during the past decade have led to greater utilization of subbituminous coals and lignites. These low-rank coals represent more than 50% of total US coal reserves and constitute a long-term, dependable indigenous energy source for electric power production. In 1975 the Brazos Electric Power Cooperative and the South Texas Electric Cooperative purchased for the San Miguel Project, a 400-MW steam generating system fueled by McMullen and Atascosa County lignite with an expected range of higher heating values from 3200 to 6350 Btu/lb. This is the lowest grade fuel that has ever been considered in the United States for use in a large, high-pressure boiler for electric power generation. The paper discusses the specific design considerations dictated by this unique lignite as well as significant features and components of the steam generating system which was supplied and erected in its entirety by the Babcock and Wilcox Company.

12273 (GFETC/IC—82/1, pp 336-346) **Prospects for industrial lignite use along the Gulf Coast.** Leonard, R.L.; White, D.M. (Radian Corp., Austin, TX). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

In 1978, Texas and Louisiana accounted for 21% of all energy used by US industry and 46% of nationwide use of natural gas by industry. They contain nine of the nation's 11 largest industrial centers as measured by energy consumption in large boilers and combusters. Given this concentration of industrial fuel use, several national studies have identified the coastal region extending from Corpus Christi, Texas, to the Mississippi River as having major potential for using coal (including lignite) as an industrial fuel. In addition, the opportunity also exists for the use of coal as a feedstock in organic chemical and synthetic fuels manufacturing and refining. Lignite-related technologies which appear to have particular application in this region are conventional combustion, fluidized-bed combustion, low and medium Btu gasification, and combined cycle/cogeneration. In order to assess the prospects for industrial use of lignite, several regulatory and structural considerations must be assessed. The Fuel Use Act prohibits the construction of large boilers which use natural gas or oil as a primary fuel, but provides numerous exemption opportunities. The Natural Gas Policy Act will significantly increase gas prices through the removal of price controls on production. The Clean Air Act influences industrial facility siting and growth as well as requiring environmental control technologies to reduce air pollutant emissions. All of these laws are currently under review by the Reagan Administration and may be revised substantially in the near future. The uncertainty introduced by this review of regulatory policy is expected to slow industrial decision-making regarding the use of lignite.

12274 (GFETC/IC—82/1, pp 471-489) **Unique features and operating experiences of the 1500-MW Laramie River Station utilizing Powder River Basin subbituminous coal.** Wade, D.; Boettcher, B. (Missouri Basin Power Project, Wheatland, WY). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The Laramie River Station is a 1500 megawatt coal-fired station located in Wheatland, Wyoming. In addition to state and federal environment regulations, the plant has a zero discharge stipulation requiring stringent plant design criteria and closed-systems monitoring for the life of the facility. Discussed in this paper are areas of the plant which were designed and are being operated for best control of these requirements. These basic areas include water treatment, coal handling, flue-gas scrubbing, and the main plant itself. Start-up problems and general operating conditions and experiences with this equipment are also discussed. The water treatment plant is a primary treating facility which includes a reverse-osmosis system. Powder River Basin subbituminous coal is burned. The flue-gas desulfurization systems are a wet limestone process utilizing a common waste and dewatering system. The main plant contains a pulverized coal-fired boiler, a tandem-compound, four-flow turbine; a generator utilizing a Generrex excitation system; and auxiliary equipment. The condenser cooling water utilizes mechanical draft cooling towers and operates at high cycles of concentration.

12275 (GFETC/IC—82/1, pp 504-545) **Recent research on ash fouling in combustion of low-rank coals.** Honea, F.I.; Montgomery, G.G.; Jones, M.L. (Grand Forks Energy Technology Center, ND). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Ash fouling is a recognized problem encountered while burning some low-rank Western US Coals. Research on the mechanism of ash deposition and tests on the ash fouling potential of selected low-rank coals has been conducted at Grand Forks Energy Technology Center (GFETC) for about 14 years. In order to get a better estimate of the impact of ash fouling in terms of boiler outages and curtailments of up to 23.7% for a high-fouling, high-sodium lignite. In a separate test program, 19 additives were identified and tested in the ash fouling test furnace to evaluate their effectiveness in reducing fouling deposit weight or strength. Limestone and magnesium oxide were identified as two of the best potential additives at low dose rates (about 5 lb/t of coal). This paper summarizes the results of the ash-related survey and the additives test program. Also, recent research activities in ash mechanism and tests with other potential fuels are described briefly.

12276 **(GTR—2913) Preliminary design of an alternate high-temperature turbine. A topical report for Phase II of the High-Temperature-Turbine Technology Program.** Strough, R.I. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Aug 1981. Contract AC01-76ET10349. 55p. NTIS, PC A04/MF A01. Order Number DE83005215.

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The feasibility of designing a convectively air-cooled turbine to operate in the environment of a 3000°F combustor exit temperature with maximum turbine airfoil metal temperatures held to 1500°F was established. The United Technologies-Kraftwerk Union V84.3 gas turbine design was used as the basic configuration for the design of the 3000°F turbine. Turbine cooling requirements were determined based on the use of the modified V84.3 type silo combustor with a pattern factor of 0.1. The convective air-cooling technology levels in terms of cooling effectiveness required to satisfy the airfoil cooling requirements were identified. Cooling schemes and fabrication technologies required are discussed. Turbine airfoil cooling technology levels required for the 3000°F engine were selected. The performance of the 3000°F convectively air-cooled gas turbine in simple and combined cycle was calculated. The 3000°F gas turbine combined-cycle system provides an increase in power of 61% and a decrease in heat rate of 10% compared to a similar system with a combustor exit temperature of 2210°F and the same airflow. The development of a successful 3000°F convectively air-cooled turbine can be accomplished with a reasonable design and fabrication development effort on the cooled turbine airfoils. Use of the convectively air-cooled turbine provides the transfer of technology from extensive aircraft engines developed programs and operating experience to industrial gas turbines. It eliminates the require-

ment for large investments in alternate cooling techniques tailored specifically for industrial engines which offer no additional benefits.

12277 **(PB—82-256629) Waste-heat vertical tube foam evaporation for cooling tower blowdown renovation/recycle. Project summary report.** Sephton, H.H.; Someahsaraii, K. (Envirotech-Sephton Development Center, Emeryville, CA (USA)). Feb 1982. 147p. NTIS, PC A07/MF A01.

A prototype waste-heat vertical tube foam evaporation (WH-VTFE) plant was designed, constructed, and field-tested for reducing power plant cooling tower blowdown to a small residual volume of solids slurried in brine, while producing distilled water for reuse. Facility design was based on previously-developed pilot plant test data. The WH-VTFE facility was constructed for initial parametric testing in upflow/downflow evaporation modes with boiler steam. The field test/demonstration phase was conducted at a power plant site using turbine exhaust steam for the up to 50-fold cooling tower blowdown concentration in a foamy-flow seed-slurried mode of downflow vertical tube evaporation. The VTFE heat transfer coefficient ranged between 5600 to 9000 W/sq m/degree, over 4-fold the level considered as acceptable in another study. Further, a sufficient temperature difference is available within a typical power plant heat rejection system to operate a WH-VTFE when the plant load is above 50% of its design capacity. Scale formed from inadequate brine recycle rates was readily removed by recycling fresh water through the evaporator to restore the high heat transfer performance of the WH-VTFE. It was concluded that WH-VTFE was demonstrated as feasible and commercially viable.

12278 **(PB—83-101782) Assessment of groundwater usage at Chalk Point power plant. Final report.** (Trident Engineering Associates, Inc., Annapolis, MD (USA)). Jul 1982. 66p. NTIS, PC A04/MF A01.

In order to quantify the usage of ground water in an operating electric power plant, a study was initiated in 1978 aimed at determining where in the energy conversion process ground water is used and to suggest, if possible, alternate means for providing this water and/or methods to reduce consumption. The Chalk Point Plant was selected for this study because of its difference in fuel source (coal and oil), and because of its high consumption of ground water (approximately 800,000 to 1,200,000 gallons per day). Located at the confluence of the Patuxent River and Swanson Creek in the southeast corner of Prince George's County, Maryland, it consists of three operating units, with a fourth unit under construction during the survey time. (unit 4 has recently become operational). With the cooperation of the Potomac Electric Power Company, the plant was selected for study and was instrumented with several flow meters. Over a two-year period, this plant has been monitored to provide the information needed to make an assessment of the rates, nature, and methods of water usage in an operating power plant.

12279 **(PB—83-103994) Environmental evaluation of European power plant cooling systems: a polish research project.** Gadkowski, M.; Czarnecka-Nieminska, E.; Spoz-Dragan, H. (Institute of Meteorology and Water Management, Warsaw (Poland)). Apr 1982. 90p. NTIS, PC A05/MF A01.

The following subjects are discussed: equipment for water treatment and condenser cleaning in once-through cooling systems; Impact of open and closed cooling systems on surface water quality; make-up water demand and water loss in closed cycle cooling systems.

12280 **Coal-fired combined-cycle power generating plants of the future.** Fejer, A.A. (Inst. of Gas Tech., Chicago, IL). pp 189-213 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

The need for efficient utilization of our energy supply has brought attention to the combined-cycle power generating plants that combine highly efficient high-temperature gas turbines with steam cycles operating on the heat energy discharged by the turbines. Because of our ample supplies of coal, combined-cycle power plants that are coal-fired are of greatest interest. Many coal-fired combined-cycle systems, involving a variety of concepts, are currently being developed, in most cases under joint support by the Federal Government, power equipment manufacturers, and engineering firms. Some of the most promising among those in advanced stages of development are discussed in this overview.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 11685, 11686, 12270, 12508, 13051, 13096

12281 **(DOE/FC—1009) Baghouse performance and ash characterization at the Arapahoe Power Station.** Dahlin, R.S.; Sears, D.R.; Green, G.P. (Southern Research Inst., Birmingham, AL (USA); Department of Energy, Grand Forks, ND (USA). Grand Forks Energy Technology Center; Public Service Co. of Colorado, Denver (USA)). 1982. Contract AC18-80FC10225. 18p. (CONF-821041—2). NTIS, PC A02/MF A01. Order Number DE83004340.

From 4. symposium on the transfer and utilization of particulate control; Houston, TX, USA (11 Oct 1982).

Portions of document are illegible.

This paper presents the results of a field test conducted in March 1981, on the Unit 3 baghouse of the Arapahoe Station of the Public Service Company of Colorado. The unit was burning a subbituminous coal from Routt County, Colorado, and was retrofitted with a baghouse in 1979. Baghouse performance was found to be excellent with an overall mass efficiency of 99.98%. The estimated cumulative collection efficiency of all particles smaller than two microns was 99.92%. The Grand Forks Energy Technology Center of the US Department of Energy, through its contractor Southern Research Institute, is conducting a series of field tests to study the characteristics and control of fly ash from the combustion of low-rank Western coals. Emphasis is being placed on two types of coal: Western subbituminous coal and Texas lignite. The overall objective of the project is to provide data that will be useful in evaluating particulate control technologies for these coals. To date, two field tests have been performed. The first field test, the subject of this paper, was conducted in march 1981, at Unit 3 of the Arapahoe Power Station of the Public Service Company of Colorado. The unit, retrofitted with a baghouse that was placed in service in May 1979, was burning a low-sulfur subbituminous coal from Routt County, Colorado. The second field test, which was jointly sponsored by DOE and EPRI, was completed in May 1982 at the San Miguel Station of the San Miguel Electric Cooperative located between San Antonio and Corpus Christi, Texas. Results of the San Miguel test will be reported elsewhere.

12282 **(DOE/FC/10200—T5) Dry-limestone injection test at a low-rank coal-fired power plant. Final report.** Blythe, G.M. (Radian Corp., Austin, TX (USA)). Nov 1982. Contract AC18-80FC10200. 83p. NTIS, PC A05/MF A01. Order Number DE83005164.

Portions of document are illegible. Printed copy available until stock is exhausted.

A total of seven tests were conducted at the Otter Tail Power Company, Hoot Lake Station to determine the effectiveness of limestone injection in controlling flue gas sulfur dioxide (SO_2) emissions. The unit tested, Unit 2, is a 53-MW lignite-fired boiler with tangential burners. The key variables for the tests were limestone injection rate, injection location, and burner firing configuration (low-NO/sub x/ versus conventional firing). The observed effects of these variables are discussed briefly. Sulfur dioxide removal efficiencies were found to increase with calcium-to-sulfur mole ratio (expressed as the ratio of moles of calcium carbonate in limestone injected to moles of sulfur in the lignite). The range of calcium-to-sulfur mole ratios tested varied from 1.6:1 to 5.0:1. The resulting SO_2 removal efficiencies varied from 21 percent at the lowest calcium-to-sulfur mole ratio to 47 percent at the highest mole ratio tested. The resulting limestone utilization values ranged from 9 to 15 percent, with the lowest value being observed when injecting limestone at the highest mole ratio. Limestone utilization is defined as the percentage of limestone that actually reacts with sulfur dioxide to form calcium sulfite or sulfate solids. Choice of injection location was not found to significantly affect SO_2 removal efficiencies. Six of the tests were conducted in a low-NO/sub x/

firing, or overfire air mode. In a seventh test, limestone was injected through the burners while operating in a conventional firing mode. However, variations of firing mode did not appear to affect SO_2 removal performance. Apparently, the large particle size of the limestone leaving the pulverizer during burner injection had a greater influence in limiting results than did the burner firing mode.

12283 (GFETC/IC—82/1, pp 362-378) **Application of dry additives on reducing SO_2 emission for brown coal-fired boilers.** Hein, K.R.G.; Glaser, W. (Rheinisch-Westfaelisches Elektrizitaetswerk, Essen, Germany). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Based on research results from combustion trials for Rhine brown coals, a flue gas desulfurization process using dry calcium-based materials as additives with the fuel, has been proposed. The applicability of this process was tested for several years in a research program at a brown coal-fired utility boiler (175 t/h steam production). After the description of the specific fuel properties and their relation to desulfurization, the main test results are presented. It will be shown that the natural retention ability of brown coals can be improved by blending the additive with the fuel prior to the grinding system. Different reactivities and, hence, variable SO_2-removal efficiencies are determined for the investigated additives: $CaCO_3$, $Ca(OH)_2$, CaO, and dolomite.

12284 **(PB—82-257213) Ohio River Basin energy study: health aspects.** Shapiro, M.A.; Sooky, A.A. (Ohio River Basin Energy Study, Urbana, IL (USA)). Nov 1980. 319p. NTIS, PC A14/MF A01.

This report was prepared as part of the Ohio River Basin Energy Study (ORBES), a multi-disciplinary program supported by the Environmental Protection Agency. It attempts to establish health damage functions for energy resource extraction, conversion (i.e., burning of coal to produce electricity), and power transmission in the ORBES region, which consists of all of Kentucky, most of West Virginia, and substantial portions of Illinois, Indiana, Ohio and Pennsylvania. Also covered in the report are patterns of mortality and health services in the study region and baseline data on health aspects of coal and uranium extraction, of coal-fired and nuclear-fueled electrical generation, of transportation and electrical transmission.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 12668

12285 **(DOE/ET/29101—33) Fabrication, interfacing, and testing of a special-purpose power-system simulator. Topical report, October 3-December 31, 1982.** Gareis, G.E.; Krause, P.C. (Purdue Univ., Lafayette, IN (USA)). 3 Jan 1983. Contract AC02-78ET29101. 3p. NTIS, PC A02/MF A01. Order Number DE83004885.

Some work has been done on modification of DCU calculation routines but the majority of the time has been spent on the Simulator Initialization Routine. As expected it has proved to be difficult to accommodate the unusual conditions that could exist after setting DCU's because of defaults or erroneous estimation of initial conditions for the DCU Calculation routines. Reasonably good results have been obtained for some individual worst case conditions but additional tests are required for various combinations of worst case conditions for different modules before the routine can be considered to be satisfactory. A small amount of work has also been done on the Simulator User's manual.

12286 **Ensuring power-system stability.** Douglas, J.; Iveson, R.; Mitsche, J.; Lamont, J. (Electric Power Research Inst., Palo Alto, CA). *EPRI (Electric Power Research Institute) Journal;* 7: No. 9, 6-13(Nov 1982).

Electric-power-system planners face increasing challenges in maintaining system reliability as regulatory and judicial delays, high interest rates, siting difficulties, and the problems inherent in longer transmission lines confront them. When outages became troublesome in the late 1970s, utility planners and the Electric Power Research Institute (EPRI) intensified research efforts on power-system expansion and complex computer codes that will prevent adverse operator decisions. Thermal analysis of transmission lines and voltage and stability limitations are the focus of research efforts. Regional differences in utility networks complicate the problems. EPRI projects in computer modeling are analyzing large-scale power-system disturbances. 1 figure. (DCK)

21 NUCLEAR POWER PLANTS

12287 **(KFK—3291) Results of research and development work 1981 of the Institute for Neutron Physics and Reactor Engineering.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Feb 1982. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750942.

The Institute for Neutron Physics and Reactor Engineering deals with research problems concerning nuclear engineering, and above all those that are related with the development of sodium-cooled fast reactors. The activities are almost equally of an experimental and theoretical nature. Most of these research activities are effected in the form of projects in co-operation with other institutes and industrial organizations. For the Fast Breeder Project the Institute is working on reactor physical design- and safety problems of the core of large fast breeder reactors. Questions concerning the effects of accidents in lightwater reactors upon the environment and population are handled as a part of the Nuclear Safety Project. The Institute participates in the Reprocessing Project by calculations on the physics of the fuel cycle and by developing control instruments based on neutron counting for a reprocessing plant. Similar instrumentation developments are also effected for the main aspect of the works which is the safeguarding of nuclear material. Technical-physical questioning on the fusion by inertia enclosure are treated in form of non-project institution works. Moreover, the use of nuclear energy in the field of traffic with hydrogen as energy carrier is examined.

12288 **Reliability and system analysis of nuclear desalination plants based on operation experience.** Kutbi, I.I. Ames, IA; Iowa State Univ. (1981). 289p. University Microfilms Order No.82-09,140.

Thesis (Ph.D.).

The prospects of using nuclear energy in Saudi Arabia for desalination and electric power generation represent a challenging engineering problem. Three specific issues have been considered for a dual-purpose plant, namely: (1) Impact of the availability and reliability of the desalination plants, (2) Integration of the desalination and power production stages, and, (3) Safety considerations of dual systems. The operational history data of the Jeddah desalination plants are studied, to determine the reliability of a multi-stage flash (MSF) desalination plant and a reverse osmosis plant (RO). The analysis of the operation history of both desalination plants revealed some very important factors which have been considered. The implications of dual-purpose nuclear desalination plants are discussed for technical, safety, and operational aspects of these plants. Also, the schemes of integration of nuclear steam supply systems with the MSF plant are presented. A comparison of RO and MSF processes from the point of view of reliability, safety, and compatibility with nuclear power as an energy source is presented. Finally, the overall availability of nuclear desalination plants is estimated based on actual data from operating experience.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 11849, 12331, 12335, 12344, 12362, 12388, 12405, 12406, 12410, 12411, 12413, 12414, 12415, 12418, 12419, 12420, 12424, 12425, 12426, 12444

12289 **(EGG-M—20482) Safety analysis of Kuosheng Mark III SRV piping response to discharge loading.** Miller, G.K. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 7p. (CONF-821037—48). NTIS, PC A02/MF A01. Order Number DE83003225.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

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The Taipower Company of Taiwan performed several safety relief valve (SRV) discharge tests at the Kuosheng Nuclear Power Station in August 1981. The tests included single, consecutive, and multiple valve actuations performed to verify design adequacy of plant piping, structures, and equipment by measuring accelerations and strains throughout the containment facility. The test instrumentation was provided by Nutech International and Bechtel Power Corporation. This paper describes a safety analysis of the Kuosheng Mark III SRV piping performed to predict its response to discharge loading. Results of the dynamic analysis were used to show that stresses in the SRV piping and its supports due to discharge loading fall within safe limits prescribed by the ASME Boiler and Pressure Vessel Code. The experimental results were used to support this position. This evaluation did not include stresses resulting from thermal expansion of the pipe nor fatigue effects from numerous valve actuations.

12290 **(EUR—7575) Experimental investigation of the enthalpy- and mass flow-distribution in 16-rod clusters with BWR-PWR-geometries and conditions. Final report of the ISPRA test-series with the complete data set.** Herkenrath, H.; Hufschmidt, W.; Jung, U.; Weckermann, F. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 252p. NTIS (US Sales Only), PC A12/MF A01. Order Number DE82703345.

The enthalpy- and mass-flow-distribution at the outlet of two different 16-rod cluster test sections with uniform heating in axial and radial direction under steady state conditions has been measured for the first time by simultaneous sampling of 5 from 6 present characteristic subchannels in the bundle using the isokinetic technique and analysing the outlet quantities by a calorimetic method. The test-sections are provided with typical geometrical configurations for BWR s (70 bars; test section PELCO-S) and PWR s (160 bars; test-section EUROP). The latter has also been tested under BWR conditions (70 bars) to study the influence of geometry and pressure. The results showed the abnormal behaviour of the corner subchannel under BWR typical conditions (70 bars) which could not be found for PWR conditions (160 bars) and which is only an effect of pressure and not of geometry. The analysis of the experimental data confirms the usefullness of the subchannel sampling technique for the better understanding of the complex thermohydraulic phenomena under two-phase flow conditions in multirod bundles. Calculations of subchannel resistance coefficients for both types of spacers under one-phase flow conditions have been made with a special sub-structure method which showed a rather high local value of the corner subchannel. With the local drag coefficents the total resistance of the spacer has been evaluated and agreed well with measured values under adiabatic conditions. The measured subchannel data permit a direct valuation and examination of respective computer codes in a fundamental manner which are, however, not subject of this report.

12291 **(GEAP—22077) Fuel-rod vibration in two-phase flow.** Hayes, C.G. (General Electric Co., San Jose, CA (USA). Nuclear Engineering Div.). Mar 1982. Contract AC02-77ET34209. 92p. NTIS, PC A05/MF A01. Order Number DE83004455.

The results of a test program investigating the flow-induced vibration (FIV) characteristics of fuel rods subjected to various thermal hydraulic flow conditions (single-phase flow, two-phase inlet flow, and boiling flow) are presented. The effects of single-phase fluid temperature, mass flux, two-phase inlet quality and bundle power on the FIV characteristics of fuel rods are reported.

12292 **(GEAP—22211) Flow-induced vibration characteristics of the BWR/5-201 jet pump.** LaCroix, L.V. (General Electric Co., San Jose, CA (USA). Nuclear Fuel and Special Projects Div.). Sep 1982. Contract AC02-77ET34209. 131p. NTIS, PC A07/MF A01. Order Number DE83003975.

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A General Electric boiling water reactor BWR/5-201 jet pump was tested for flow-induced vibration (FIV) characteristics in the Large Steam Water Test Facility at Moss Landing, CA, during the period June-July 1978. High level periodic FIV were observed at reactor operating conditions (1027 psia, 532°F and prototypical flow rates) for the specific single jet pump assembly tested. High level FIV of similar amplitude and character have been shown capable of damaging jet pump components and associated support hardware if allowed to continue unchecked. High level FIV were effectively suppressed in two special cases tested: (1) lateral load (>500 lb) at the mixer to diffuser slip joint; and (2) a labyrinth seal (5 small, circumferential grooves) on the mixer at the slip joint. Stability criteria for the particular jet pump tested were developed from test data. A cause-effect relationship between the dynamic pressure within the slip joint and the jet pump vibration was established.

12293 **(GEAP—24381) Fuel-rod vibration with reduced spacer spring preload.** Hayes, C.G. (General Electric Co., San Jose, CA (USA). Nuclear Energy Div.). Dec 1981. Contract AC02-77ET34209. 61p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83004456.

Portions of document are illegible. Printed copy available until stock is exhausted.

The results of a test program investigating the effects of fuel spacer constraint forces on the flow-induced vibration (FIV) characteristics of fuel rods are presented. The spacer constraint forces were reduced to four percent of nominal in both a 3 x 3 rod bundle and single rod configuration. The test results did not indicate that decreasing fuel spacer constraint forces have an appreciable effect on fuel rod vibration.

12294 **(NUREG/CR—2751-Vol.2) Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982.** Whitman, G.D.; Bryan, R.H. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 146p. (ORNL/TM—8369-Vol.1). NTIS, PC A07/MF A01 - GPO. Order Number DE83002146.

The three-dimensional finite-element program for elastic-plastic fracture analysis was adapted to the analysis of stainless-steel-clad structures under combined pressure and thermal-shock loads. Subcontractors continued their support of thermal-shock experiments and investigation of fracture mode transitions and crack-arrest testing. Statistical analyses of irradiated Charpy impact specimens were completed, and plans wer made for two new irradiation studies, high-copper welds and stainless steel cladding. Further overcooling accident analyses were made, and preliminary studies of the next thermal-shock experiments were conducted. Preparations for the test of intermediate vessel V-8A continued, objectives were established for three pressurized-thermal-shock (PTS) tests, and procurement activities for the PTS test facility were initiated. Five flawed plates were tested in the stainless steel cladding investigations.

12295 **(NUREG/CR—2797) Evaluation of events involving service water systems in nuclear power plants.** Haried, J.A. (Oak Ridge National Lab., TN (USA)). Nov 1982. Contract W-7405-ENG-26. 66p. (ORNL/NSIC—207). NTIS, PC A04/MF A01 - GPO $5.00. Order Number DE83004300.

This report reviews and evaluates events involving the plant service water systems in US commercial boiling- and pressurized-water systems in US commercial boiling- and pressurized-water reactors from January 1979 through June 1981. The information was collected from operating experiences, licensee event reports, system designs in safety analysis reports, and other regulatory documents. The results were collated and analyzed according to: (1) safety significance; and (2) cause of event. Sixteen reports describe events in the last 2.5 years of operating experience that meet the criteria for safety significance; another 21 reports describe events that were judged to be possibly safety significant. At Brunswick 1 on April 19, 1981, the plant service water system did not fulfill its safety design criteria on demand. However, an alternate cooling path was established, and the reactor was adequately cooled. Few human errors caused events of safety significance, though they were frequent enough to affect plant performances. Differences between events at boiling- and pressurized-water reactors were minimal.

12296 **(NUREG/CR—2836-Vol.1-Pt.2) Buckling of steel containment shells. Task 1b. Buckling of Washington Public Power Supply Systems' plant No. 2 containment vessel. Final report, 25 August 1980-30 September 1982.** Meller, E.; Bushnell, D. (Lockheed Palo Alto Research Labs., CA (USA)). Dec 1982. 124p. (LMSC-D—812950-Vol.1-Pt.2). NTIS, PC A07/MF A01 - GPO $6.00. Order Number DE83901036.

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Static buckling analyses of the steel containment vessel of the Washington Public Power Supply Systems' (WPPSS) plant No. 2 were conducted with use of several computer programs developed at the Lockheed Missiles and Space Company (LMSC). These analyses were conducted as part of Task 1, Evaluation of Two Steel Containment Designs. The report is divided into two main sections. The first gives results from analyses of the containment as if it were axisymmetric (computerized models with use of BOSOR4, BOSOR5, and PANDA), and the second gives results from a STAGSC-1 model in which the largest penetration is included. Good agreement is obtained from analyses with BOSOR5 and STAGSC-1 for a case in which both of these computer programs were applied to the same configuration and loading. It is important to include nonlinear material behavior (plasticity) in the computerized models for collapse. Predictions of collapse from STAGSC-1 indicate that the largest penetration of the WPPSS-2 containment vessel is reinforced such that there is no decrease in load carrying capability below that indicated from models in which this penetration is neglected.

12297 **Operating US power reactors.** Silver, E.G. (comp.). *Nuclear Safety;* **23**: No. 5, 593-602(Sep-Oct 1982).

The operation of US power reactors during May and June 1982 is summarized. Events of special note are discussed in the text, and the operational performance of all licensed power reactors is presented. These data are taken from the monthly Operating Units Status Report prepared by the Nuclear Regulatory Commission (NRC).

12298 **TRAC-PD2 Calculations of CREARE countercurrent flow tests.** Bott, T.F. (LASL, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **35**: 317-318(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 11847, 11849, 11855, 11883, 12290, 12293, 12294, 12295, 12297, 12334, 12335, 12344, 12362, 12388, 12389, 12390, 12393, 12394, 12396, 12397, 12398, 12405, 12407, 12410, 12411, 12412, 12413, 12414, 12418, 12419, 12423, 12426, 12427, 12435, 12439, 12444

12299 **(BLG—552) Study of the corrosion products in the primary system of PWR plants as the source of radiation fields build-up.** Brabant, R. van; Regge, P. de. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). Jan 1982. 185p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE82703346.

In the first part the behaviour of the corrosion products in the primary system of PWR plants is depicted on the basis of a literature review of the field. Water chemistry, corrosion processes and activation of corrosion products are the main topics. In the second part the results of the characterization of corrosion particles in the primary coolant circuit of the Doel 1 and 2 reactors are described, during steady state operation and transient phases. In the third part the possibilities for radiation control at nuclear power plants are outlined. The filtration possibilities for the reactor coolant are explored in detail.

12300 **(CEA-N—2259) Synthesis and simulation of corrector filter used for local measurement in PWR core from gamma thermometer signal.** Fontana, Xavier. (Paris-11 Univ., 91 - Orsay (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1982. 184p. (In French). NTIS (US Sales Only), PC A09/MF A01. Order Number DE82703347.

Thesis.

The feasibility of gamma thermometry in PWR is presented. The influence of different parameters on the instrumentation is described together with a solution to improve results. A mathematical pattern followed by a computer simulation allows a visualization of the gamma thermometer behavior in typical transients.

12301 **(CNEN-DR—102/81) Insertion of control systems models in the Almod 3 computer code for the simulation of Angra I reactor start-up tests.** Camargo, C.T.M. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). Sep 1981. 103p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82703392.

The Almod 3 computer code was modified, aiming at the simulation of Angra I nuclear power plant behavior during some reactor start-up tests. The results obtained with the modified computer code (Almod 3W) are compared with those obtained with the Retran computer code.

12302 **(DOE/ET/34015—4) Investigation of on-line chelant addition to PWR steam generators. Annual report, 1981.** Tvedt, T.J.; Wallace, S.L.; Griffin, F. Jr. (Dow Chemical U.S.A., Freeport, TX. Texas Div.). Nov 1982. Contract AC02-79ET34015. 47p. NTIS, PC A03/MF A01. Order Number DE83004803.

The thermostability of both ethylenediaminetetraacetic acid (EDTA) and hydroxyethylethylenediaminetriacetic acid (HEDTA) metal chelates in all volatile treatment water chemistry (AVT) was shown to be greater than or equal to thermostability of EDTA metal chelates in phosphate-sulfite water chemistry. HEDTA metal chelates were shown to have a much greater stability than EDTA metal chelates. Using samples taken from the EDTA metal chelate thermostability studies and samples from Commonwealth Research Corporation (CRC) model steam generators (MSG), EDTA decomposition products were determined. Active metal surfaces were shown to become passivated when exposed to EDTA and HEDTA concentrations as high as 0.1% w/w in AVT. Trace amounts of iron in the water were found to increase the rate of passivation. Material balance and visual inspection data from CRC model steam generators showed that metal is being transported through and cleaning from the MSG's. EDTA metal chelates were removed from chelate solutions by passing the solutions over strong anion exchange resins.

12303 **(DOE/ET/34030—4) High-burnup PWR ramp test program. Background topical report, Petten ramp test results.** LaVake, J.C.; Gaertner, M. (Combustion Engineering, Inc., Windsor, CT (USA). Power Systems Group; Kraftwerk Union A.G., Erlangen (Germany, F.R.)). 1982. Contract AC02-80ET34030. 141p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83003393.

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The objective of this program, which is sponsored by DOE and conducted by Combustion Engineering and Kraftwerk Union, is to investigate the power ramp behavior of high burnup PWR-type fuel under fast power ramp conditions. This will be accomplished by performing twenty ramp tests on rodlets having approximately 33 and 45 GWd/MtU burnup and reporting as background information the test results from 68 previously ramped fuel rodlets. Included among these tests are rodlets having modified designs to determine if such designs will improve PCI behavior. The rodlets are first irradiated in the Obrigheim power reactor (PWR) in Germany and then ramp tested in the High Flux Reactor at Petten, Netherlands. This topical report covers Part 1 of the program, providing fabrication, base-irradiation, intermediate examination and ramp test results for the 68 test rodlets included in the background data base.

12304 **(ELETROBRAS-CDTN—01/81) Analysis of minimum operational costs for PWR nuclear power plants.** Muniz, A.A.; Azevedo, J.B.L. de. (ELETROBRAS, Rio de Janeiro (Brazil). Dept. de Recursos Energeticos). Jul 1981. 51p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703348.

The possibilities and the consequences of PWR nuclear power plants operation for the peak supply are analyzed. Two hypothesis for the minimum operative cycle, at hourly level are proposed.

12305 **(EPRI-NP—2638) Boiling in narrow crevices in steam generators. Final report.** Merte, H. Jr.; Arpaci, V.S.; Selamoglu, S.; Tieszen, S. (Michigan Univ., Ann Arbor (USA). Dept. of Mechanical Engineering and Applied Mechanics). Nov 1982. 255p. NTIS, PC A12/MF A01. Order Number DE83900741.

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Objective is to understand the heat transfer characteristics and mechanisms associated with boiling in the annuli of the tube-tube support plate crevices which exist in steam generators. The approach is both analytical and experimental in nature, with a model developed which qualitatively predicts the trends found in the data. The experimental work consists of testing a single tube in a unit cell geometry to a maximum of 200 psia on the secondary side for the purpose of visual as well as numerical results. The experimental results are limited to the Flow Distribution Plate with a test matrix completed for the variables of Geometry, Flow Rate, Pressure, Heat Flux, and Subcooling. Three distinct boiling regimes are found to exist which correspond to those which have previously been found to exist in pool boiling: the isolated bubble regime, the coalesced or cylindrical bubble regime, and the dryout regime. The isolated bubble regime exists in the highest annular areas and its character is similar to unconfined flow boiling. The coalesced or cylindrical bubble regime exists in annulus heights on the order of 0.010 inches and is characterized by thin film evaporation under large cylindrical bubbles. The dryout regime is a local dryout occurring in annulus heights under 0.005 inches between a tube and tube support plate. These regimes are highly dependent on the local geometry, but are relatively insensitive to changes in flow rate, heat flux and subcooling. The cylindrical bubble regime decreases in size somewhat with increasing pressure.

12306 **(EPRI-NP—2701) Electrochemical behavior of ferrous and ferric ions in EDTA/N_2H_4 solutions.** Chen, C.M.; Jevec, J.M. (Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.). Oct 1982. 30p. NTIS, PC A03/MF A01. Order Number DE83900751.

Laboratory testing was conducted and electrochemical measurements were made to develop an understanding of the conditions controlling the behavior of ferric (Fe^{+3}) and ferrous (Fe^{+2}) ions in solutions of ethylenediaminetetraaceticacid (EDTA) and hydrazine (N_2H_4). Such solutions are being considered for use in the chemical removal of magnetite (Fe_3O_4) deposits from the secondary side of pressurized water reactor (PWR) steam generators.

12307 **(EPRI-NP—2706) Secondary water chemistry control at St. Lucie No. 1.** Putkey, T.A.; Pearl, W.L.; Sawochka, S.G. (NWT Corp., San Jose, CA (USA)). Oct 1982. 90p. NTIS, PC A05/MF A01. Order Number DE83900752.

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Plant design and operating philosophy relative to secondary cycle chemistry control at St. Lucie Nuclear Power Station Unit 1 were reviewed. St. Lucie 1 experienced moderate steam generator corrosion (tube denting) after only 17 months of commercial operation. Since the corrosion appeared related to the introduction of contaminants into the secondary cycle from intermittent condenser tube leakage, the condenser was retubed with titanium, and integrally grooved tubesheets were installed. Recently a new type of corrosive attack was found at the U-bend region of both steam generators. The precise nature and cause of this attack have not yet been determined.

12308 **(NUREG—0952) Technical specifications: San Onofre Nuclear Generating Station, Unit No. 3, Docket No. 50-362. Appendix A to license No. NPF-15.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1982. 454p. NTIS, PC A20/MF A01 - GPO $11.00. Order Number DE83900030.

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This report includes the following sections: definitions, safety limits and limiting safety system settings, limiting conditions for operation and surveillance requirements, bases, design features, and administrative controls. (DLC)

12309 **(PUC-DEM—03/81) Effect of tube plugging in the thermalhydraulic performance of 'U' tube steam generators.** Braga, C.V.M.; Carajilescov, P. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Engenharia Mecanica). May 1981. 40p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703349.

The thermalhydraulic performance of Angra II steam generator has been simulated using the model developed by Braga, C.V.M., 'Thermohydraulic model for steam generator of PWR power plants', in steady state, with plugging up to 40% of total number of tubes.

12310 **Iterative solution to the optimal control of depletion problem in pressurized water reactors.** Colletti, J.P. University Park, PA; Pennsylvania State Univ. (1981). 189p. University Microfilms Order No.82-05,898.

Thesis (Ph.D.).

A method is described for determining the optimal time and spatial dependence of control absorbers in the core of a pressurized water reactor over a single refueling cycle. The reactor is modeled in two dimensions with many regions using two-group diffusion theory. The problem is formulated as an optimal control problem with the cycle length fixed and the initial reactor state known. Constraints are placed on the regionwise normalized powers, control absorber concentrations, and the critical soluble boron concentration of the core. The cost functional contains two terms which may be used individually or together. One term maximizes the end-of-cycle (EOC) critical soluble boron concentration, and the other minimizes the norm of the distance between the actual and a target EOC burnup distribution. Results are given for several test problems which are based on a three-region model of the Three Mile Island Unit 1 reactor. The resulting optimal control strategies are bang-bang and lead to EOC states with the power peaking at its maximum and no control absorbers remaining in the core. Throughout the cycle the core soluble boron concentration is zero.

12311 **Extended burnup fuel cycle optimization for pressurized water reactors.** Ho, A.L.B. Lafayette, IN; Purdue Univ. (1981). 190p. University Microfilms Order No.82-10,203.

Thesis (Ph.D.).

A fast, yet accurate fuel cycle analysis methodology has been developed to optimize the various options for in-core nuclear fuel management. The methodology encompasses two major parts: the multi-cycle point reactor model PUFLAC and reload pattern optimization using DSPWR. PUFLAC provides a convenient and reliable survey ability to explore the various fuel cycle scheme possibilities while DSPWR utilizes a direct search scheme to minimize the core power peaking with consideration given to local power peaking factor variation. A two-dimensional nodal code P2D used in this direct search scheme was developed for the power distribution calculations and is based on EPRI-NODE-P with very good agreement obtained.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 12335, 12410

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

REFER ALSO TO CITATION(S) 12400

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 11847, 12344, 12364, 12366, 12370, 12395, 12427, 12440, 12445

12312 **(CTA-EAV-NT—003/81) Possible types of breeders with thorium cycle.** Ishiguro, Y.; Gouveia, A.S. de. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Atividades Espaciais). Feb 1981. 25p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703351.

Neutronics calculations of simplified homogeneous reactor models show the possibility that metal-fueled LMFBRs and coated particle fueled gas cooled reactors achieve reactor doubling times of around 10 years with the thorium cycle. Three concepts of gas-cooled thorium cycle breeders are discused.

12313 **(CTA-EAV-NT—004/81) JFS libraries and the effect of beryllium on the breeding.** Ishiguro, Y.; Gouveia, A.S. de. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Atividades Espaciais). Feb 1981. 8p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703352.

The Japanese group constants libraries for fast reactor analysis JFS-25 and JFS-70 are compared. The effect of beryllium on the breeding characteristics of thorium cycle breeders is examined. The results show that the 25-group set predicts shorter reactor doubling times than the 70-group set and that the effect of Be(n,2n) reactions is negligible.

12314 **(DOE/ET/37240—98TR-Pt.1) User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis.** Wong, C.N.C.; Cheng, S.K.; Todreas, N.E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Jan 1982. Contract AC02-76ET37240. 217p. NTIS, PC A10/MF A01. Order Number DE83003272.

Portions of document are illegible.

This report provides the HEATRAN user with programming and input information. HEATRAN is a computer program which is written to analyze the transient three dimensional single phase incompressible fluid flow and heat transfer problem. In this report, the programming information is given first. This information includes details concerning the code and structure. The description of the required input variables is presented next. Following the input description, the sample problems are described and HEATRAN's results are presented.

12315 **(DOE/ET/37240—98TR-Pt.2) User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis.** Wong, C.N.C.; Cheng, S.K.; Todreas, N.E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Jan 1982. Contract AC02-76ET37240. 224p. NTIS, PC A10/MF A01. Order Number DE83003273.

Portions of document are illegible.

A 3-D distributed parameter code, HEATRAN, has been developed to calculate detailed velocity and temperature fields in the coolant and cladding temperature distribution in a wire-wrapped rod assembly. The code structure is discussed and the input description is presented. The program listings and sample problems of HEATRAN's several versions are included in the Appendices.

12316 **(PUC-DEM—04/81) Measurements of peripherical static pressure and pressure drop in a rod bundle with helical wire wrap spacers.** Ballve, H.; Graca, M.C.; Fernandez y Fernandez, E.; Carajilescov, P. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Engenharia Mecanica). Jul 1981. 103p. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82703353.

The fuel element of a LMFBR nuclear reactor consists of a wire wrapped rod bundle with triangular array with the coolant flowing parallel to the rods. By using this type of element with seven rods conected to an air open loop, the hydrodynamics behavior of the flow for p/d = 1.20 and l/d = 15.0, was simulated. Several measurements were performed in order to obtain the static pressure distribution at the walls of the hexagonal duct, for Reynolds number from $4.4x10^3$ to $48.49x10^3$ and for different axial and transverse positions, in a wire wrap lead. The axial pressure drop was obtained and the friction factor dependence with the Reynolds number was determined. From the obtained results, it was observed the non-dependency of the non-dimensionalized axial and transverse local static pressure distribution at the wall of the hexagonal duct, with the Reynolds number. The obtained friction factor is compared to the results of previous works.

12317 **(PUC-DEM—05/81) Semi-empirical model for the calculation of flow friction factors in wire-wrapped rod bundles.** Carajilescov, P.; Fernandez y Fernandez, E. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Engenharia Mecanica). Aug 1981. 34p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703354.

LMFBR fuel elements consist of wire-wrapped rod bundles, with triangular array, with the fluid flowing parallel to the rods. A semi-empirical model is developed in order to obtain the average bundle friction factor, as well as the friction factor for each subchannel. The model also calculates the flow distribution factors. The results are compared to experimental data for geometrical parameters in the range: P(div)D = 1.063 - 1.417, H(div)D = 4 - 50, and are considered satisfactory.

12318 **(PUC-DEM—06/81) State of art of the methods for thermohydraulics design of LMFBR fuel elements.** Fernandez y Fernandez, E.; Carajilescov, P. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Engenharia Mecanica). Sep 1981. 32p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703355.

The present (experimental and analytical) state of the art of the methods for thermohydraulics design of LMFBR fuel elements is analyzed. A development program is suggested, in order to obtain a computer code for modelling the distribution of coolant enthalpy in reactor core. This computer code is in development.

12319 **(RRC—49) Determination of carbon in sodium by the distillation-combustion method.** Bhat, N.P.; Ranganathan, R.; Pillai, S.R. (Reactor Research Centre, Kalpakkam (India)). 1981. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900584.

This report describes in detail a distillation-combustion method for estimation of total carbon in sodium. The sodium sample is taken in a quartz crucible and the sodium is distilled under vacuum in an all glass vessel with induction heating. The crucible is then combusted in a furnace at 1100°C in oxygen and the liberated carbon dioxide is collected in a molecular sieve trap and estimated by the low pressure method. 3 to 4 grams of sodium is taken for analysis. Carbon in sodium has been estimated in the range of 10 to 20 ppM with excellent precision. There is no loss of carbonate or graphite carbon which is confirmed by standard addition and recovery experiments. The method can be used for estimation of carbon in sodium from experimental loops and in commercial sodium where carbon levels are above 1 ppM. Results are presented for carbon removal experiments and also for sodium samples from experimental loops in RRC. A separate method is described for estimation of carbonate carbon in sodium.

12320 **Heat, mass, and momentum transfer from large two-phase bubbles.** Bradley, D.R. Charlottesville, VA; Univ. of Virginia (1981). 224p. University Microfilms Order No.82-08,494.

Thesis (Ph.D.).

Knowledge of the motion of the two-phase fuel bubble following a Hypothetical Core Disruptive Accident (HCDA) in a Liquid Metal Fast Breeder Reactor (LMFBR) is important from the standpoint of radiological risk assessment. The goal of this work is the analytical modeling of current two-phase expansion experiments in order to obtain a better understanding of the heat, mass, and momentum transfer mechanisms which influence bubble motion. Equations governing axial motion of the bubble are proposed. The axial forces which are considered are buoyancy, free and rigid surface effects, and drag. Heat and mass transfer from the two-phase fuel bubble is modelled using the UVABUBL computer

code. Radiation heat transfer is assumed to be the primary mechanism for heat loss from the bubble. Heating of the vapor-coolant interface and entrained droplets results in vaporization of the coolant once it has been heated to the saturation temperature. Thermodynamic equilibrium is assumed to exist in the two-phase, multicomponent mixture within the bubble.

12321 **(RISLEY-Trans—4174) In-pile fuel cycle of heterogeneous oxide fast reactors.** Kujal, J.; Kujal, B.; Matveev, V.I.; Novozilov, A.I.; Bobrov, S.B. (CONF-790933—6-Trans). (UKAEA Risley Nuclear Power Development Establishment). 6 Nov 1979. Translation of IAEA-SM-244/10. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900466.

Portions of document are illegible.

The paper discusses the principles of the basic techniques on which the SORYR computer programs are based. These programs include an ABBN 26-group data library which enables calculations to be carried out for operating fast reactors taking into account reloading and fuel burnup. For purposes of comparison the starting model chosen was a conventional reactor using oxide fuel and sodium coolant. The change to a heterogeneous core was made on the assumption that the basic technical and thermal characteristics of the reactor were retained. The results of calculations of the neutron characteristics of the in-pile fuel cycle of heterogeneous reactors are given and compared with conventional reactors. The influence of a radial and axial configuration of the breeding blanket on the basic characteristics and their variation between reloadings was investigated. The last part of the report describes the results of calculations which show how the breeding characteristics change with an increase in the number of fertile assemblies in the core for 2 different fuel and fertile assembly compositions and for a different degree of plutonium production in the fertile assembly. Results are also given of optimizing investigations of a pepper and salt core.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

12322 **(LA-UR—82-3279) Conceptual designs for 100-MW space radiators.** Prenger, F.C.; Sullivan, J.A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 35p. (CONF-821103—50). NTIS, PC A03/MF A01. Order Number DE83003542.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Portions of document are illegible.

A description and comparison of heat rejection systems for multimegawatt space-based power supplies is given. Current concepts are described, and through a common performance parameter, these are compared with three advanced radiator concepts. The comparison is based on a power system that rejects 100 MW of heat while generating 10 MW of electrical power.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 12366, 12405, 12407, 12413, 12437

12323 **(CNEN-DR—87/80) Reactor licensing in the United States and Federal Republic of Germany.** Salvatore, J.E.L. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). Feb 1980. 39p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703380.

The licensing procedure for nuclear power plants in the United States and in the Federal Republic of Germany is analysed. The security policy, the inspections and the supervision during their construction and operation are discussed.

12324 **(CNEN-DR—89/80) Licensing procedure for construction and operation of nuclear power plants.** Salvatore, J.E.L. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). Mar 1980. 34p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703381.

The licensing procedure for the construction and operation of the nuclear power plants in Brazil is analysed, according to the International Atomic Energy Agency orientation. The risks related to the nuclear energy is also emphasized.

12325 **(INFO—0051) Licensing and safety of nuclear power plants in Canada.** Boyd, F.C. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Sep 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703382.

From IAEA interregional course on nuclear power plant operational safety; Karlsruhe, Germany, F.R. (Sep 1981).

An overview of the regulatory framework and licensing process for nuclear power plants in Canada is given along with an outline of the evolution of the safety philosophy followed and some comments on how this philosophy and process could be applied by a country embarking on a nuclear power program.

12326 **(INFO—0054) Recommendations on AECB draft licensing guides nos. 40, 41, 42.** (Atomic Energy Control Board, Ottawa, Ontario (Canada). Advisory Committee on Nuclear Safety). Jun 1981. 5p. (ACNS—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703384.

Recommendations are made to the Canadian Atomic Energy Control Board concerning three draft licensing guides: no. 40, Requirements for containment systems for CANDU nuclear power plants; no. 41, Requirements for shutdown systems for CANDU nuclear power plants; and no. 42, Requirements for emergency core cooling systems for CANDU nuclear power plants. Emphasis is on issues common to all three documents, and on underlying safety principles.

12327 **(INFO—0055) Proposed statement on safety objectives for nuclear activities in Canada.** (Atomic Energy Control Board, Ottawa, Ontario (Canada). Advisory Committee on Nuclear Safety). Jun 1981. 6p. (ACNS—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703385.

This report presents a concise statement of the basic safety objectives which the Committee considers underlie, or should underlie, the regulations and the licensing and compliance practices of the Atomic Energy Control Board. The report also includes a number of general criteria for achieving these objectives.

12328 **(NUREG—0540-Vol.4-No.8) Title list of documents made publicly available, August 1-31, 1982.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). 1982. 587p. NTIS, PC A25/MF A01 - GPO. Order Number DE83900979.

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The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979.

12329 **(NUREG—0750-Vol.15-No.6) Nuclear Regulatory Commission issuances.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Jun 1982. 411p. NTIS, PC A18/MF A01 - GPO. Order Number DE83900459.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), The Directors' Decisions (DD), and the Denials of Petitions For Rulemaking (DPRM).

12330 **(NUREG—0871-Vol.1-No.4) Summary information report.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Nov 1982. 50p. NTIS, PC A03/MF A01 - GPO. Order Number DE83900778.

The Summary Information Report (SIR) provides summary data concerning NRC and its licensees for general use by the Chairman, other Commissioners and Commission staff offices, the Executive Director for Operations, and the Office Directors. SIR is published quarterly by the Management Information Branch (49-27834) of the Office of Resource Management.

12331 **(NUREG—0892-Suppl.2) Safety evaluation report related to the operation of WPPSS Nuclear Project No. 2, Docket No. 50-397, Washington Public Power Supply System.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1982. 28p. NTIS, PC A03/MF A01 - GPO $4.50. Order Number DE83900926.

Supplement 2 to the Safety Evaluation Report for Washington Public Power Supply System's application for a license to operate WNP-2 (Docket No. 50-397), located in Benton County, Washington, approximately 12 miles north of Richland, Washington, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement reports the status of certain items that had not been resolved at the time of publication of the Safety Evaluation Report and Supplement 1.

12332 **Status of power-reactor projects undergoing licensing review.** Silver, E.G. (comp.). *Nuclear Safety;* **23**: No. 5, 624-630(Sep-Oct 1982).

Recent regulatory and other actions relating to power reactors undergoing licensing review are summarized as of July 1, 1982. Except as otherwise noted, all the information presented in this article is taken from NRC press releases or from the reactor docket file, both of which are available at the NRC Public Document Room, 1717 H Street NW, Washington, DC 20555.

2108 Economics

REFER ALSO TO CITATION(S) 11847, 12304, 12476

12333 **(DOE/EIA/10683—T2) International nuclear-model prototype: program descripttion.** Andress, D.A. (Scientific Systems, Inc., Kensington, MD (USA)). Jul 1982. Contract AC01-80EI10683. 851p. NTIS, PC A99/MF A01. Order Number DE83003800.

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This manual gives an overview of the prototype International Nuclear Model (INM) code and presents a detailed system design for the full International Nuclear Model. INM is a comprehensive model of all sectors of the nuclear power industry. The model simulates the economic decision process in the nuclear industry and determines the costs, power generation, construction schedule, and fuel-cycle mass flows. The International Nuclear Model covers the following nuclear fuel cycle sectors: natural supply (mining and milling); conversion and enrichment; fabrication; reactors (power generation); temporary storage (at-reactor and away-from-reactor); permanent disposal; and recyoling. The purpose of the International Nuclear Model is to predict the future of the nuclear power industry. This includes the number and type of nuclear reactors and fuel cycle facilities, the cost of building and operating reactors and fuel cycle facilities, and the flow of fuel, both intra and cross regional, through the fuel cycle.

12334 **(DOE/ET/34013—5) Evaluation and demonstration of methods for improved nuclear fuel utilization. Fourth semiannual progress report, July 1 to December 31, 1981.** (C-E Power Systems, Windsor, CT (USA); Arkansas Power and Light Co., Little Rock (USA)). Mar 1982. Contract AC02-79ET34013. 59p. (CEND—399). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83004278.

The objective of this Department of Energy sponsored program is to demonstrate increased burnup for Combustion Engineering 16 x 16 fuel. A demonstration of this improvement is in progress for the Arkansas Nuclear One Unit 2 (ANO-2) reactor located near Russellville, Arkansas. Analyses are included to assure that the extended-burnup objective can be realized with both conventional and low-leakage fuel-management schemes. This report is the fourth semiannual progress report and covers the progress made from July 1, 1981 through December 31, 1981. This report presents fuel management analyses for transitions to extended burnup for ANO-2, investigations of the adequacy of cross section modeling, and the adequacy of power distribution measurements at extended burnup. Startup of the ANO-2 Cycle 2 occurred in June 1981. Advanced design fuel rods are experiencing their first exposure cycle, and current design 16 x 16 fuel assemblies are now in their second cycle, having a peak rod average burnup of 16 GWD/T at the end of Cycle 1.

12335 **(DOE/NE—0048) UPDATE: nuclear-power-program information and data, July-September 1982.** (USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Converter Reactor Deployment). Nov 1982. 103p. NTIS, PC A06/MF A01. Order Number DE83004130.

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UPDATE is published by the Office of Converter Reactor Deployment, Office of Nuclear Energy, to provide a quick reference source on the current status of nuclear powerplant construction and operation in the United States and for information on the fuel cycle, economics, and performance of nuclear generating units. Similar information on other means of electric generation as related to nuclear power is included when appropriate. The subject matter of the reports and analyses presented in UPDATE will vary from issue to issue, reflecting changes in foci of interest and new developments in the field of commercial nuclear power generation. UPDATE is intended to provide a timely source of current statistics, results of analyses, and programmatic information proceeding from the activities of the Office of Nuclear Energy and other components of the Department of Energy, as well as condensations of topical articles from other sources of interest to the nuclear community.

12336 **(DOE/RG/10268—T2) Funding nuclear-power-plant decommissioning. Final report.** Burns, R.E.; Henderson, J.S.; Pollard, W.; Pryor, T.; Chen, Y.M. (National Regulatory Research Inst., Columbus, OH (USA)). Oct 1982. Contract FG01-80RG10268. 134p. NTIS, PC A07/MF A01. Order Number DE83004137.

The report is organized according to the steps that one might go through when analyzing funding of decommissioning costs. The first step in analyzing decommissioning costs might be to review the present regulatory framework within which decommissioning cost decisions must be made. A description is presented of the present NRC regulations that address the decommissioning of a nuclear power plant. A description is also presented of recent public utility commission activities concerning funding the costs of decommissioning. Possible future trends in NRC regulation are also discussed. The estimation of decommmissioning costs is analyzed. A description of each of the possible decommissoining options is presented. The options of decommissioning include immediate dismantlement, various types of safe storage, and entombment. A discussion is presented of cost estimations for each decommissioning option for nuclear units containing pressurized water reactors and boiling water reactors. A description is included of the various methods of collecting funds for decommissioning as well as a discussion of their possible regulatory treatment. Material is presented which will provide the reader with background information that might assist state utility commissioners or their staffs in choosing or evaluating one of the financial mechanisms for covering decommissioning costs.

22 NUCLEAR REACTOR TECHNOLOGY

REFER ALSO TO CITATION(S) 12287

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 12436, 12442

12337 (AAEC/E—539) ANAUSN - a one-dimensional multigroup SN transport theory module for the AUS reactor neutronics system. Clancy, B.E. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). May 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703329.

ANAUSN is a general purpose, one-dimensional discrete ordinate transport theory program which has access to AUS data pools. Fixed source, reactivity and a variety of criticality search calculations can be performed. The program can be operated as a module in the AUS scheme or as a stand-alone program.

12338 (BARC—1129) Iterative solutions of finite difference diffusion equations. Menon, S.V.G.; Khandekar, D.C.; Trasi, M.S. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 185p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE82703332.

The heterogeneous arrangement of materials and the three-dimensional character of the reactor physics problems encountered in the design and operation of nuclear reactors makes it necessary to use numerical methods for solution of the neutron diffusion equations which are based on the linear Boltzmann equation. The commonly used numerical method for this purpose is the finite difference method. It converts the diffusion equations to a system of algebraic equations. In practice, the size of this resulting algebraic system is so large that the iterative methods have to be used. Most frequently used iterative methods are discussed. They include : (1) basic iterative methods for one-group problems, (2) iterative methods for eigenvalue problems, and (3) iterative methods which use variable acceleration parameters. Application of Chebyshev theorem to iterative methods is discussed. The extension of the above iterative methods to multigroup neutron diffusion equations is also considered. These methods are applicable to elliptic boundary value problems in reactor design studies in particular, and to elliptic partial differential equations in general. Solution of sample problems is included to illustrate their applications. The subject matter is presented in as simple a manner as possible. However, a working knowledge of matrix theory is presupposed.

12339 (EGG-PHYS—6003) Raffle V general purpose Monte Carlo code for neutron and gamma transport. Wheeler, F.J.; Easson, S.A.; Grimesey, R.A.; Wessol, D.W. (Idaho National Engineering Lab., Idaho Falls (USA)). Aug 1982. Contract AC07-76ID01570. 171p. NTIS MF $6.25. Order Number DE83003129.

Mf only; illegibility does not permit PC reproduction. Includes 12 sheets of 48x reduction microfiche.

The RAFFLE V general-purpose Monte Carlo code is an extensively-modified version of the original RAFFLE code developed at INEL. This document describes the RAFFLE V code, emphasizing the modifications made since prior documentation.

12340 (IAE—3376/5) Multigroup program for calculating the thermal neutron utilization factor in multizone cylindrical reactor cell (MGPRAKTINETs). Sultanov, N.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 47p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703333.

The MGPRAKTINETs computer code for the BESM-6 computer intended for calculation of zone average thermal neutron group fluxes and functionals is described. The neutron spatial-energy distribution in a multizone cylindrically-symmetric reactor cell is calculated by the operator splitting method. For the solution of the spatial part of the problem the method of surface pseudo-sources (Gsub(N)-approximation) in approximation of plane derivatives from the energy neutron current is employed. The energy part of the problem is solved in a multigroup approximation. Computer code efficiency has been demonstrated by calculation of two-zone cells with internal and external sources of the cell with on additional absorber and RBMK cell with reduction of the latter to cylindrical geometry. It is shown that the approximation of plane derivatives of neutron energy current allows calculating reactor cell characteristics with a sufficient for design calculations accuracy.

12341 (ITEF—106(1981)) TRIFOB code for calculating the isotope composition change in a cylindrical reactor cell with detailed accounting for neutron spatial and energy distribution. Vostrikov, M.A.; Kochurov, B.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703334.

The description of the TRIFOB computer code intended for calculating the isotope composition spatial change and physical characteristics of nuclear reactor cells in the burnup process is given. The results of the WWER-365 reactor spent fuel isotope composition calculation are compared with the calculation results by other methods and experimental data. The calculation of nuclear process rapidities is based on the solution of a multigroup system of integral neutron transport equations in transport approximation. The account of quickly changing in time process rapidities the case of resonance absorbers is realized by means of an interpolation technique.

12342 (ORNL—5897-Vol.1) Engineering Physics Division progress report period ending May 31, 1982. (Oak Ridge National Lab., TN (USA)). Jul 1982. Contract W-7405-ENG-26. 18p. NTIS, PC A10/MF A01. Order Number DE82018215.

Portions of document are illegible. Printed copy available until stock is exhausted.

Progress is described in the following areas: nuclear cross sections and related quantities; methods for generating and validating multigroup cross-section libraries; methods for reactor and shield analysis; methods for sensitivity and uncertainty analysis; integral experiments and nuclear analyses (integral experiments supporting fusion reactor designs, nuclear analyses supporting fusion reactor designs, high-energy particle transport calculations, integral experiments supporting gas-cooled fast breeder reactor designs, nuclear analyses supporting gas-cooled reactor designs, nuclear analyses supporting utilization of light-water reactors, and integral experiment analyses supporting surveillance dosimetry improvement program); energy economics modeling and analysis; safety and reliability assessments for nuclear power reactors; and information analysis and distribution. Publications and papers presented are listed. (WHK)

12343 (UFRJ-COPPE-PEN—102) Notes on multigroup diffusion kinetics. Watson, F.V. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). Feb 1981. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703336.

A discussion on the neutron kinetics problem modeled through the multigroup-diffusion equations is presented. Current methods of its numerical solution are surveyed and evaluated. In an effort to make the numerical solution as general as possible as far as different types of transients are concerned, a new method based on the integro-differential formulation and a combination of some new and previously known methods are introduced.

12344 Third Specialists Meeting on Reactor Noise. Thie, J.A. *Nuclear Safety;* 23: No. 5, 549-559(Sep-Oct 1982).

The Third Specialists Meeting on Reactor Noise was held in Tokyo, Japan, October 26-30, 1981. Attendees, representing 15 countries, gave experimental data and theoretical interpretations for random fluctuation phenomena in commercial power plants and in related research center experimental facilities. Topics included pressurized-water-reactor, boiling-water-reactor, and fast-reactor noise during operation; investigations of boiling detection, temperature noise, and flow properties; noise analysis methods; and aspects of power reactor noise theory. Twenty-four different practical applications, some of which are new, were given in the 56 papers presented.

12345 **Destabilization of Leidenfrost boiling by a sudden rise of ambient pressure.** Sharon, A.; Bankoff, S.G. (Northwestern Univ., Evanston, IL). *Chemical Engineering Science;* 37: No. 8, 1173-1179(1982).

The contact of two liquids, one at a temperature significantly above the boiling point of the other, can lead to fast vapor formation on an explosive time scale causing mechanical damage. Such an event, generally termed a "vapor explosion", has been recognized as the cause of accidents in a wide variety of smelting and liquefied natural gas (LNG) industries. The increase of awareness of the problem, especially in hypothetical accidents in liquid metal fast breeder reactors (LMFBR), has resulted in a broad research effort to investigate the sequence of events and the necessary conditions leading to a vapor explosion. A key step in the explosion scenario has been identified as the destabilization of film boiling, resulting in liquid-liquid contact over a large area. It is found experimentally that, when the ambient pressure is suddenly increased around an evaporating volatile drop suspended above a hot liquid surface, the vapor film may or may not collapse.A theory is developed here in which instability corresponds to resonance between the oscillations in the creeping-flow vapor film thickness and the capillary waves on the underside of the drop surface. Two separate estimates are made of the critical vapor film thickness at which instability occurs, one by a creeping flow model of the film thickness oscillation, and the other by a Taylor-Helmholtz instability model. The two models are in agreement with each other and with the data.

12346 **Nonlinear diffusion theory model for xenon-induced flux oscillations.** Teachman, J.D. Blacksburg, VA; Virginia Polytechnic Inst. and State Univ. (1981). 173p. University Microfilms Order No.82-06,781.

Thesis (Ph.D.).

A nonlinear model is developed for the xenon induced flux oscillation problem that occurs in nuclear power plants. The model is based on Galerkins's method of weighted residuals applied to multigroup diffusion theory. A similar linear model is developed by the same methods in order to consider the effects of the nonlinearities of the system. The effects of multi- and single-energy group considerations are also examined. Finally the effects of various number of basis functions used to approximate the flux, iodine, and xenon concentrations is determined. A partial listing of the computer program XORA, developed from the nonlinear and linear models, is given along with representative input and output from this program.

12347 **Integral transport multiregion geometrical shadowing factor for the approximate collision probability matrix calculation of infinite closely packed lattices.** Jowzani-Moghaddam, A. University Park, PA; Pennsylvania State Univ. (1981). 402p. University Microfilms Order No.82-05,926.

Thesis (Ph.D.).

An integral transport method of calculating the geometrical shadowing factor in multiregion annular cells for infinite closely packed lattices in cylindrical geometry is developed. This analytical method has been programmed in the TPGS code. This method is based upon a consideration of the properties of the integral transport method for a nonuniform body, which together with Bonalumi's approximations allows the determination of the approximate multiregion collision probability matrix for infinite closely packed lattices with sufficient accuracy: The multiregion geometrical shadowing factors have been calculated for variations in fuel pin annular segment rings in a geometry of annular cells. These shadowing factors can then be used in the calculation of neutron transport from one annulus to another in an infinite lattice. The result of this new geometrical shadowing and collision probability matrix are compared with the Dancoff-Ginsburg correction and the probability matrix using constant shadowing on Yankee fuel elements in an infinite lattice. In these cases the Dancoff-Ginsburg correction factor and collision probability matrix using constant shadowing are in difference by at most 6.2% and 6%, respectively.

12348 **Nodal analysis for reactor kinetics and stability.** Park, J.K. Troy, NY; Rensselaer Polytechnic Inst. (1981). 165p. University Microfilms Order No.82-10,674.

Thesis (Ph.D.).

General space kinetics models have been developed for more accurate stability analysis utilizing nodal analysis, a commonly used technique for analyzing power distributions in large power reactors. Kinetics parameters for use in these kinetics models have been properly derived by utilizing self-consistent nodal data and power distributions. The procedure employed in the nodal code SIMULATE has been utilized for power distribution, since that methodology is general and includes various commonly used nodal methods as special cases. Cross sections are correlated as functions of void fraction and exposure. A computer program investigating thermo-hydrodynamic stability, NUFREQ has been modified to accommodate general spatial kinetics models with an improved thermal-hydraulics model. The thermal-hydraulic models used are lumped and distributed parameter heated wall dynamics models with or without heat flux perturbations in the two-phase region. The assumptions used in the thermal-hydraulic models are separated flow, non-uniform heat flux including spacer effects. The Nyquist criterion has been utilized to obtain stability margins corresponding to the kinetics model. Development of general space kinetics model made it possible to evaluate more accurate stability margins, and it is possible to analyze the influences of operating conditions on stability for any system with void perturbations due to external perturbation.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 12402

12349 **(CEA-CONF—6157) Effects of an annular fluid on the critical speed of a rotating shaft.** Guidez, J.; Axisa; Gibert; Girard; Fardeau. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Nov 1981. 29p. (CONF-8111118—1). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703337.

From Fluid-structure interactions in turbomachinery conference; Washington, DC, USA (15 Nov 1981).

Prediction of vibrations of rotors when passing through the flexural critical velocities is important for industrial applications. Pumps of nuclear reactors are a typical example characterized by a rotor which rotates at relatively low speed in a dense fluid like water or sodium. In such configurations critical velocities and natural frequencies of the equivalent beam system may differ significantly, mainly because of fluids effects. A brief review of the physical mechanisms involved is presented and a numerical code: ROTOR, based on the finite element method, is described which allows for a linear analysis of rotors, taking into account also the non conservative forces associated with the gyroscopic and the fluid effects. Finally the practical importance of fluid is emphasized by some experimental results obtained on two pump-shaft models working in water. Results are discussed in relation with the code expectations. For completely immersed rotors the computed critical velocities are found to be in good agreement with the experimental values. However for partially immersed rotors further experimental and theoretical work is still needed.

12350 **(NUREG/CR—2836-Vol.1-Pt.1) Buckling of steel containment shells. Task 1a. Dynamic response and buckling of offshore power systems' floating nuclear plant containment vessel. Final report, 25 August 1980-30 September 1982.** Meller, E.; Bushnell, D. (Lockheed Palo Alto Research Labs., CA (USA)). Dec 1982. 258p. (LMSC-D—812950-Vol.1-Pt.1). NTIS, PC A12/MF A01 - GPO $8.00. Order Number DE83901035.

Portions of document are illegible.

Static and dynamic analyses of the steel containment vessel of the Offshore Power Systems' (OPS) floating nuclear plant were conducted with use of several computer programs developed at the Lockheed Missiles and Space Company (LMSC). These analyses were conducted as part of Task 1, Evaluation of Two Steel Containment Designs. The main purpose was to evaluate the OPS containment shell with respect to buckling. The report is divided into two main sections, the first giving results from modal vibration and linear dynamic response analyses of the OPS containment neglecting and including the large equipment hatch and the second giving results from buckling analyses for a variety of models. It is con-

cluded that inclusion of the equipment hatch and its attachments does not significantly affect the dynamic response of the OPS vessel to the loading history provided by OPS. Good agreement is obtained for static stress and buckling predictions from PANDA, BOSOR4, BOSOR5, and STAGSC-1 for cases in which more than one of these computer programs can be applied to the same configuration and loading.

12351 **(NUREG/CR—2927) Nuclear power plant electrical cable damageability experiments.** Lukens, L.L. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 40p. (SAND—82-0236). NTIS, PC A03/MF A01 - GPO. Order Number DE83003734.

Under the direction of the Nuclear Regulatory Commission, Sandia National Laboratories has been conducting confirmatory research in fire protection for nuclear power plants. As a part of this research, a program was developed to determine the damageability of electrical-cable insulation to thermal radiation in a loaded cable tray. The critical flux or threshold level at which cable damage occurs in the form of electrical failure (short from conductor to tray) and nonpiloted ignition was determined for two types of electrical cable, one an IEEE-383 qualified cable and the other an unqualified cable. A program was also developed to determine the damageability of electrical-cable insulation to constant temperature, thermal exposure.

12352 **(NUREG/CR—2966) Buckling investigation of ring-stiffened cylindrical shells under unsymmetrical axial loads.** Baker, W.; Bennett, J.; Babcock, C. (Los Alamos National Lab., NM (USA)). Oct 1982. Contract W-7405-ENG-36. 78p. (LA—9536-MS). NTIS, PC A05/MF A01 - GPO. Order Number DE83005348.

Portions of document are illegible.

Two buckling experiments are described in detail. The first purpose of these experiments is to establish baseline values for the buckling loads and modes for ring-stiffened cylindrical shells that have geometric parameters characteristic of the ring-stiffened cylindrical section of a typical nuclear steel containment vessel. A series of follow-on experiments on nominally identical ring-stiffened cylinders that have framed and reinforced penetrations typical of nuclear industry practice are planned and will be described in a separate report. This report is issued separately because of the volume of detail included on methods, measurements, and data reduction techniques. In addition, a second purpose of these experiments is to serve as a set of benchmark experiments for computer codes that can predict buckling loads for axisymmetric geometries, and in this respect this work stands alone. Complete material stress-strain curves are described and complete geometric imperfection data for the shells are given. These data are also available in digitized form on tape. Typical load-strain information is reported, as well as the distribution of load around the cylinder at buckling. A method for taking and reducing chord gage measurements to characterize the out-of-roundness imperfections is also examined in detail and comparisons to actual imperfection sweep measurements are made.

12353 **(NUREG/CR—2997-Vol.1) Applications of energy release rate techniques to part-through cracks in plates and cylinders. Volume 1. ORMGEN-3D: a finite element mesh generator for 3-dimensional crack geometries.** Bass, B.R.; Bryson, J.W. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 73p. (ORNL/TM—8527-Vol.1). NTIS, PC A04/MF A01 - GPO. Order Number DE83003701.

This report (Volume 1) describes the ORMGEN-3D (Oak Ridge Mesh GENerator - 3D) finite element mesh generator program for computational fracture mechanics analysis. The program automatically generates a three-dimensional (3-D) finite element model for six different crack geometries. These geometries include flat plates with straight or curved surface cracks and cylinders with part-through cracks on the outer or inner surface. Mathematical or user-defined crack shapes may be considered. ORMGEN-3D generates a core of special wedge or collapsed prism elements at the crack front to introduce the appropriate stress singularity at the crack tip. Regular 20-node isoparametric brick elements are used elsewhere in the modeling. Also, a cladding option is available that allows for an embedded or penetrating crack in the clad material. As few as four input cards are required to execute the program. ORMGEN-3D is part of a three-program system, ORMGEN-ADINA-ORVIRT, which addresses linear or nonlinear fracture in 2- or 3-D crack geometries.

12354 **(SRD-R—203) Survey of defects in pressure vessels in the UK for the period 1962-1978 and its relevance to nuclear primary circuits.** Smith, T.A.; Warwick, R.G. (UKAEA Risley Nuclear Power Development Establishment, Culcheth. Safety and Reliability Directorate). Dec 1981. 34p. United Kingdom Atomic Energy Authority, Culcheth Warrington WA3 4NE, England.

Data are obtained from surveyors' reports in which detected faults are appraised, analyzed and fitness for continued service considered. Two categories of failure are defined: (1) potential; and (2) catastrophic (disruptive) failures. Results of the survey indicate that from more than 3×10^5 vessel years service accumulated by some 20,000 vessels the potential failure rate is 6.9×10^{-4} per vessel year averaged over the survey period and the catastrophic failure rate for the same period is 4.2×10^{-5} per vessel year. In addition to failure rates it is important to obtain information on defect causes, mechanisms, locations and the material involved. These, togetcher with other relevant data, are listed in the paper. Published American and German data are also referred to and commented on. Operating experience with nuclear reactor vessels and their associated heat exchangers in the UK and USA amounts to approximately 4×10^3 vessel years. This is insufficient to provide a significant body of data from which to establish meaningful failure probabilities for reactor vessels. The problem of transferring data obtained from conventional plant to nuclear plant is discussed.

12355 **(UFRJ-COPPE-PEN—107) Stress analysis for nuclear power plant components.** Mueller, R.A. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). Sep 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703340.

The general procedure for a meaningful stress evaluation will be outlined. The extremely aggravated conditions prevailing at elevated temperatures, at which creep effects can no longer be neglected, will also be touched upon briefly.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 12311

12356 **(IPEN-Inf—08) Introduction to current modeling techniques in nuclear fuel performance analysis.** Faya, S.C.S. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Oct 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703341.

An overview of several important phenomena considered in fuel performance analysis, such as fuel restructuring, fuel swelling, fission gas release, pellet cracking, etc... are provided. All these phenomena are independent. For the purpose of illustration of integral fuel rod analysis the LIFE-1 computer code is discussed.

12357 **(IPEN-Inf—09) Survey on fuel pellet cracking and healing phenomena in reactor operation.** Faya, S.C.S. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Oct 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703342.

In normal reactor operation, oxide fuel pellets will crack. The majority of the pellet segments will lie against the cladding. When temperature in the central region of the fuel during irradiation is raised to the plastic region, crack healing occurs. The repetition of cracking-healing-cracking sequence resulting from repeated power cycle has a significant effect on fuel relocation. The fuel pellet relocation must be known since it effects the cladding life time. The fuel pellet cracking and healing phenomeno in reactor operation are described and the pertinant method of analysis is also discussed.

12358 **(NUCLEBRAS-CDTN—434/81) Evaluation of fuel rods behavior - under irradiation test.** Lameiras, F.S.; Terra, J.L.; Pinto, L.C.M.; Dias, M.S.; Pinheiro, R.B. (Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte (Brazil)). Apr 1981. 25p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703343.

By the accompanying of the irradiation of instrumented test fuel rods simulating the operational conditions in reactors, plus the results of post-irradiation exams, tests, evaluation and calibration of analytic modelling of such fuel rods is done.

12359 **Enhanced irradiation creep deformation due to gradual temperature reductions.** Foster, J.P.; Nayak, U.P. (Westinghouse Electric Corp., Madison, PA (USA). Advanced Reactors Div.); Porter, D.L. (Argonne National Lab., Idaho Falls, ID (USA)). *Journal of Nuclear Materials;* **110**: No. 1, 95-107(Sep 1982).

Large irradiation creep strains were observed in WSA-4 mixed-oxide fuel pins at 7% burn-up and 10^{23} n cm^{-2} (E > 0.1 MeV) which were exposed to temperature variations relative to pins irradiated at approximately constant temperature. A comparison of the fuel pin and pressurized tube samples exposed to gradual temperature reductions shows similar behaviour. The results show that the irradiation creep coefficient increases with increasing temperature reduction and initial irradiation temperature. The increase in irradiation creep and the previously reported increase in swelling with temperature reduction appears similar to other macroscopic strain reports of irradiation creep and swelling association.

12360 **Gamma emmission tomography of irradiated fuel bundles.** Miles, K.J.; Holland, J.W.; Pedersen, D.R.; Reville, P. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **35**: 173(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

2204 Control Systems

REFER ALSO TO CITATION(S) 12310, 12443

12361 **(UFF-IF—03/81) Sensitivity of control times in function of core parameters and oscillations control in thermal nuclear systems.** do Amorim, E.S.; D'Oliveira, A.B.; Galvao, O.B.; Oyama, K. (Universidade Federal Fluminense, Niteroi (Brazil). Inst. de Fisica). Mar 1981. 15p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703335.

Sensitivity of control times to variation of a thermal reactor core parameters is defined by suitable changes in the power coefficient, core size and fuel enrichment. A control strategy is developed based on control theory concepts and on considerations of the physics of the problem. Digital diffusion theory simulation is described which tends to verify the control concepts considered, face dumped oscillations introduced in one thermal nuclear power system. The effectivity of the control actions, in terms of eliminating oscillations, provided guidelines for the working-group engaged in the analysis of the control rods and its optimal performance.

12362 **Technical note: handling of alarms using logic.** Visuri, P.J.; Thomassen, B.B.; Owre, F.A. (Institutt for Energiteknikk, Halden, Norway). *Nuclear Safety;* **23**: No. 5, 559-562(Sep-Oct 1982).

The concept of introducing logic and combinations of process signals into an alarm system, in general, increases the possibility of designing meaningful man-machine interfaces for complex processes. It also makes it possible for the designer to increase the sensitivity of present alarm limits to changes in the values of process parameters without being restricted by a subsequent intolerable increase in the number of incoming alarms. In this way HALO can also significantly increase the possibilities for early detection of developing disturbances. Further evaluation of the feasibility and possible benefits of using HALO in handling of process signals will attempt to take these secondary effects of the system into account.

12363 **Control and instrumentation.** Hagen, E.W. (Oak Ridge National Lab., TN). *Nuclear Safety;* **23**: No. 3, 291-299(May 1982).

The control room design review is part of a broad program being undertaken by the nuclear industry and the government to ensure consideration of human factors in nuclear power-plant design and operation. The objectives of this review are to identify and correct deficiencies in existing or committed control room equipment and physical arrangements and to improve the ability of nuclear power-plant control room operators to prevent or cope with accidents by improving the information provided to those operators.

12364 **Fast breeder reactor on-line monitoring and diagnosis strategy development via Dynamic Data System (DDS) methodology.** Chaing, S. Madison, WI; Univ. of Wisconsin (1981). 226p. University Microfilms Order No.82-06,824.

Thesis (Ph.D.).

The Dynamic Data System (DDS) methodology is used to develop a systematic monitoring and diagnosis strategy for the Liquid Metal Fast Breeder Reactor (LMFBR) in this dissertation. Four systems closely related to the LMFBR are investigated. They are (1) the Advanced Reactor Interactive Engineering Simulation (ARIES) code of the fast breeder reactor power plant, (2) the Shutdown Core Coolability Model Test (SCCMT) mock-up facility, (3) the Experimental Breeder Reactor (EBR-II) power station in Idaho, U.S.A., and (4) the Phenix Reactor, a commercial Fast Breed Reactor (FBR) power plant in France. A DDS monitoring and diagnosis strategy was developed and applied to the ARIES code studies. Three types of malfunctions: minor abnormal reactivity insertion, slow transient pump flow and subassembly flow blockage, were simulated. All were detected by the DDS monitoring scheme. Each of these failure characters were also characterized and diagnosed by DDS modeling approaches.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 11883, 12468, 13039, 13041, 13089, 13089, 13196

12365 **(INFO—0059) Role of regulatory body related to siting.** Asmis, G.J.K. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Nov 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703386.

From IAEA nuclear power course; Argonne, IL, USA (28 Sep - 20 Nov 1981).

The role of a regulatory body, the Atomic Energy Control Board of Canada, in the siting process is discussed. A description of the Board's legal structure and safety criteria is followed by an example of the implementation of these criteria in relation to the siting of the Darlington nuclear power plant, with particular reference to external hazards such as tornadoes, earthquakes and explosions.

12366 **(NUREG—0139-Suppl.1-Vol.1) Supplement to Final Environmental Statement related to construction and operation of Clinch River Breeder Reactor Plant, Docket No. 50-537.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Oct 1982. 315p. NTIS, PC A14/MF A01 - GPO $8.50. Order Number DE83900709.

In February 1977, the Office of Nuclear Reactor Regulation issued a Final Environmental Statement (FES) (NUREG-0139) related to the construction and operation of the proposed Clinch River Breeder Reactor Plant (CRBRP). Since the FES was issued, additional data relative to the site and its environs have been collected, several modifications have been made to the CRBRP design, and its fuel cycle, and the timing of the plant construction and operation has been affected in accordance with deferments under the DOE Liquid Metal Fast Breeder Reactor (LMFBR) program. These changes are summarized and their environmental significance is assessed in this document. The reader should note that this document generally does not repeat the substantial amount of information in the FES which is still current; hence, the FES

should be consulted for a comprehensive understanding of the staff's environmental review of the CRBRP project.

12367 **(NUREG—0837-Vol.2-No.2) NRC TLD direct radiation monitoring network. Progress report, April-June 1982.** Costello, F.; Thompson, T.; Cohen, L. (Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I). Nov 1982. 186p. NTIS, PC A09/MF A01 - GPO $7.50. Order Number DE83900891.

The network is operated in cooperation with participating states. The report presents the radiation exposure levels measured in the vicinities of NRC-licensed facilities throughout the country and includes facilities under construction as well as those which are in operation. A complete listing of the sites monitored is included. Each site is monitored by approximately 40 TLD stations located in concentric rings. A complete description of the program can be found in NUREG-0837, Volume 1, Numbers 1 and 2. The results of NBS testing of the NRC environmental radiation dosimeter are available in NUREG/CR-2560. Three sets of data are presented for each site. The first set includes the TLD station number, its direction and distance from the site, the integrated exposure for the period, and the exposure normalized to a ninety-day quarter (standard quarter). The second set of data summarizes in tabular form the average exposure measured in each of the sixteen standard windrose sectors around the facility and normalized to a standard quarter. The third set of data summarizes in tabular form the average exposure measured at three ranges of distances from the facility and normalized to a standard quarter.

12368 **Radioactive effluents from nuclear power stations in the European Community, 1974-1978.** Luykx, F.; Fraser, G. (Commission of the European Communities, Luxembourg). *Nuclear Safety;* **23**: No. 5, 578-586(Sep-Oct 1982).

This article covers operational nuclear power stations having a capacity greater than 50 MW(e) in the European Community. Discharges of radioactive gaseous and liquid effluents from these installations are given for the period 1974 to 1978, with values expressed both in absolute terms and normalized to net electricity production from the fuel. An assessment is then made of the exposure of members of the public resulting from the 1978 discharges. It is concluded that the exposure of members of the public from the 1978 discharges lies within the variations in exposure that result from natural background radiation.

12369 **Manpower problems in an unsettled nuclear industry.** Chewning, J.S.; Seltzer, N. (DOE, Washington, DC). *Transactions of the American Nuclear Society;* **41**: 426-427(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 11936, 12408, 12426

12370 **(HEDL-SA—2719) Improved specifications for fast reactor fuel.** Dutt, D.S.; Powers, H.G.; Schwallie, A.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 1 Jun 1982. Contract AC06-76FF02170. 14p. (CONF-821103—51). NTIS, PC A02/MF A01. Order Number DE83004072.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Approximately 80,000 Liquid Metal Fast Breeder Reactor (LMFBR) fuel pins have been fabricated for the Fast Flux Test Facility (FFTF). Manufacturing and performance experience were evaluated to determine those changes in the fuel pin specifications which would potentially effect a reduction in fuel cycle cost (without detriment to core performance) and to identify any required additional supporting tests. The task required the combined expertise of fuel design, fabrication, performance, safety and quality assurance specialists. The evaluation indicated that a substantial cost reduction could be achieved and that the required additional supporting tests for FFTF fuel could be completed prior to fuel pin manufacturing operations in the Secure Automated Fabrication (SAF) facility in 1986.

12371 **U.S. reduced enrichment research and test reactor (RERTR) program: accomplishments, plans, and schedules.** Travelli, A. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **35**: 564-566(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12372 **Status of development of high-uranium density reduced-enrichment plate-type fuels.** Stahl, D. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **35**: 566-567(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12373 **Comparative performance of a 10-MW generic reactor with HEU and LEU fuels.** Daly, T.A.; Matos, J.E. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **35**: 567-569(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12374 **Analytical comparison of Boron and cadmium absorbers in research reactors.** Deen, J.R.; Shelgrove, J.L. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **35**: 570-571(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12375 **Neutronic performance of a 14-MW TRIGA reactor LEU vs HEU Fuel.** Bretscher, M.M.; Cornella, R.J.; Snelgrove, J.L. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **35**: 573-575(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12376 **Fuel management modeling with REBUS-2 for research and test reactors.** Komoriya, H.; Cornella, R.I. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **35**: 575-576(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12377 **Burnup-dependent cross-section data for research reactors and a comparision of REBUS-2 and PDQ-7 Burnup.** Woodruff, W.L. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **35**: 576-578(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12378 **Measurement of acoustic background noise on the EBR-II steam generators.** Claytor, T.N.; Greene, D.A.; Malovrh, J. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **35**: 432(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12379 **Health Physics Research Reactor operating history and recent improvements.** Sims, C.S. (ORNL, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society, Supplement;* **32**: 53-54(1979). (CONF-790807—).

From Topical conference on reactor operating experience; Arlington, TX, USA (5 Aug 1979).

12380 **Reduced-enrichment fuel element loading calculations for the Ford Nuclear Reactor.** Komoriya, H.; Lee, J.C.; Martin, W.R. (ANL, Argonne, IL 60439). *Transactions of the American Nuclear Society, Supplement;* **32**: 31(1979). (CONF-790807—).

From Topical conference on reactor operating experience; Arlington, TX, USA (5 Aug 1979).

2208 Propulsion Reactors

12381 **(AD-A—119243/4) Research needs: prime-power for high energy space systems. Final report 26 Oct 81-31 Jul 82.** Turchi, P.J. (R and D Associates, Arlington, VA (USA)). Jun 1982. 100p. NTIS, PC A05/MF A01.

By the year 2000, an increasingly large portion of our national defense will depend on space-based systems. As part of a broader set of new research initiatives in support of space systems, the Air Force Office of Scientific Research is sponsoring basic research that may be applicable to the development of megawatt-level space prime-power systems. (The emphasis of this particular new initiative is prime-power versus pulsed power including power conditioning, such as fly-wheel or inductive storage, for which there are existing programs.) To assist AFOSR, R and D Associates organized a special conference on prime-power for high-energy space systems, compiled the proceedings of the conference, and provided a review document identifying basic research areas in support of future space prime-power development. This document is the Appendix of the present report. The intent has been to focus on basic vs applied research and to provide guidance and assistance to prospective researchers. In this last regard, a bibliography of space prime-power is contained in the appended document.

12382 **(EIR—432) Determination of the contamination and decontamination of the fuel basin of the nuclear-powered ship Otto Hahn.** Hanulik, J.; Schenker, E.; Ullrich, G. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Dec 1981. 31p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900591.

A description is given of the nuclear reactor housing of the nuclear-powered ship Otto Hahn, and the process of nuclear waste disposal. Tabulated data are given on decontamination solutions used, reaction time, and residual activity. 2 tables.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 11883, 12287, 12298, 12342, 12831, 13040, 13184, 13196

12383 **(BMFT-FB-RS—179-Pt.2) Phase separation. Final report.** (Hannover Univ. (Germany, F.R.). Inst. fuer Verfahrenstechnik). 1978. 150p. (In German). Dep. NTIS, PC A. Order Number DE82904405.

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Experimental results are given for steam separation and flow velocity in vessel blowdown. A comparison is made between a constructed phase separation model and models described in the literature. 74 references, 55 figures.

12384 **(BMFT-RS—150-365-Pt.1) Effect of physical characteristics on heat transfer over a gas free-flowing interface.** Rinkleff, L. (Hannover Univ. (Germany, F.R.). Inst. fuer Verfahrenstechnik). Dec 1981. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900600.

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A description is given of the use of holographic interferometry with relatively high accuracy to determine the heat transfer rates on a horizontal gaseous interface with respect to preventing reactor accidents and meltdown. Physical characteristics are given for various model fluids. 18 references, 8 figures, 1 table.

12385 **(BMFT-RS—150-365-Pt.2) Experimental study of heat transfer in 1- and 2-layered fluid systems perfused by gas and containing internal heat sources.** Steinberner, U. (Hannover Univ. (Germany, F.R.). Inst. fuer Verfahrenstechnik). Dec 1981. 125p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83900599.

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A study is made of the relationship of heat transfer in a gas-perfused 1- and 2-layered fluid system with internal heat sources to gas volume flow, layer density, and temperature differential between upper and lower limits. 13 references, 43 figures, 1 table.

12386 **(BMFT-RS—150-365-Pt.3) Heat transfer and fragmentation during contact between a gas-covered melt and cooling liquid.** Fritz, P. (Hannover Univ. (Germany, F.R.). Inst. fuer Verfahrenstechnik). Dec 1981. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83900598.

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A determination is made of time-dependent heat-flow density over the interface of a gas-covered metal alloy as well as a study of the associated fragmentation processes. The study entailed a eutectic bismuth/lead alloy and water as well as volatilized isobutane and water. Nitrogen was used as the cover gas. 119 references, 75 figures.

12387 **(EGG-M—18582) NRC/DAE reactor safety research Data Bank.** Laats, E.T. (Idaho National Engineering Lab., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 4p. (CONF-821037—57). NTIS, PC A02/MF A01. Order Number DE83003241.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

In 1976, the United States Nuclear Regulatory Commission (NRC) established the NRC/Division of Accident Evaluation (DAE) Data Bank to collect, store, and make available data from the many domestic and foreign water reactor safety research programs. This program has since grown from the conceptual stage to a useful, usable service for computer code development, code assessment, and experimentation groups in meeting the needs of the nuclear industry. Data from 20 facilities are now processed and permanently stored in the Data Bank, which utilizes the Control Data Corporation (CDC) CYBER 176 computer system located at the Idaho National Engineering Laboratory (INEL). New data and data sources are continually being added to the Data Bank. In addition to providing data storage and access software, the Data Bank program supplies data entry, documentation, and training and advisory services to users and the NRC. Management of the NRC/DAE Data Bank is provided by EG and G Idaho, Inc.

12388 **(EGG-M—24282) Accident Sequence Evaluation Program.** Sullivan, W.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 9p. (CONF-821037—52). NTIS, PC A02/MF A01. Order Number DE83003246.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

The Accident Sequence Evaluation Program (ASEP) is currently being conducted as a joint effort by Sandia National Laboratories; EG and G Idaho, Inc., at the Idaho National Engineering Laboratory; and Science Applications, Inc., in Albuquerque, New Mexico. ASEP evolved as a basic element of the Accident Likelihood Reevaluation portion of the NRC's Severe Accident Research Program (SARP). In this regard, ASEP will ultimately pool the information gained from other accident likelihood assessments, update this information with current knowledge and, based on this update, reassess the predictions of severe accident sequences, their likelihoods and, to a degree, their consequences. The ASEP program will then provide this information for use in other severe accident evaluations.

12389 **(EGG-SD—5159) Technical assessment of radiation overexposures at Three Mile Island from the August 28, 1979, entry into the Unit 2 Fuel-Handling Building Makeup Valve Room.** Rich, B.L.; Adams, S.R. (Idaho National Engineering Lab., Idaho Falls (USA)). Jun 1980. Contract AC07-76ID01570. 28p. NTIS, PC A03/MF A01. Order Number DE83005518.

An entry into the TMI North Makeup Valve Room of the Fuel Handling Building on August 28, 1979, resulted in high indicated beta doses to five operators and an HP foreman/surveyor. Due to the complexity of the working environment, the high-level, fission-product beta fields, and inadequate personnel dosimetry, an extensive study was undertaken to establish the personnel doses received. The Metropolitan Edison Company (Met Ed) submitted a formal over-exposure report of the results of this study to the NRC on December 5, 1979, who in turn issued a contract for an independent evaluation of the dose assessment. The independent evalua-

tion verified that the assigned doses to the skin of the legs and hands were limiting and were conservatively assigned and that the penetrating gamma dose to the body was overly conservative. It was determined that the report did not adequately reflect the quality of the technical evaluation performed in assigning the legal doses of record.

12390 **(EPRI-NP—1401-Vol.3) LOCA hydroloads calculations with multidimensional nonlinear fluid/structure interaction. Volume 3. Fluid/structure interaction studies using 3-D STEALTH/WHAMSE. Final report.** Santee, G.E. Jr.; Chang, F.H.; Mortensen, G.A.; Brockett, G.F.; Gross, M.B.; Belytschko, T.B. (Intermountain Technologies, Inc., Idaho Falls, ID (USA); Science Applications, Inc., San Leandro, CA (USA); Northwestern Univ., Evanston, IL (USA). Technological Inst.). Nov 1982. 340p. NTIS, PC A15/MF A01. Order Number DE83900753.

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This report, the third in a series of reports for RP-1065, describes the final step in the stepwise approach for developing the three-dimensional, nonlinear, fluid-structure interaction methodology to assess the hydroloads on a large PWR during the subcooled portions of a hypothetical LOCA. The final step in the methodology implements enhancements and special modifications to the STEALTH 3D computer program and the WHAMSE 3D computer program. After describing the enhancements, the individual and the coupled computer programs are assessed by comparing calculational results with either analytical solutions or with experimental data. The coupled 3D STEALTH/WHAMSE computer program is then applied to the simulation of HDR Test V31.1 to further assess the program and to investigate the role that fluid-structure interaction plays in the hydrodynamic loading of reactor internals during subcooled blowdown.

12391 **(EPRI-NP—2646) Validation of real-time software for nuclear-plant-safety applications. Final report.** Saib, S.H. (General Research Corp., Santa Barbara, CA (USA)). Nov 1982. 129p. NTIS, PC A07/MF A01. Order Number DE83900740.

Using state-of-the-art concepts in software engineering, a comprehensive methodology for developing and testing software was used in a realistic on-line nuclear plant application. Dual teams independently developed and tested the software using a formal specification language, structured programming, static test tools, and an automated test bed. The entire process was formally monitored by an independent verification and validation team that conducted specification reviews, code walk-throughs, and final verification testing. The effectiveness of the concepts is evaluated on the basis of error data, manpower requirements, and user judgments.

12392 **(EUR—7424) Fluid-structure coupling in Lagrange-Lagrange and Euler-Lagrange descriptions.** Jones, A.V. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 104p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE82703338.

Fluid-structure interaction problems are very common in the reactor safety field, examples being containment loading in LMFBR systems and the downcomer problem in LWRs. This article reviews the principal finite difference methodes employed for their solution. After a survey of the chief representations of the equations of motion of the fluid and structure and of their coupling, the Lagrange-Lagrange and Euler-Lagrange representations are examined in detail. The practical necessity of treating the structure in Lagrangian coordinates and the respective merits of the Lagrangian and Eulerian representations for the fluid are explained, both for coupling between continua and for coupling between a fluid and a thin shell. Detailed analyses of the stability and numerical dissipation of the Lagrange-Lagrange and Euler-Lagrange coupling techniques in a very simple one-dimensional problem are provided to supply indicators as to stability and dissipation in more complex multidimensional situations and to bring out the theoretical complexity of seemingly simple coupling algorithms. The article then presents some practical examples of coupled problems in which calculations can be compared with experiment, and concludes with a section on future trends in the field of fluid-structure coupling.

12393 **(GAO/EMD—82-90) Response to questions raised concerning TMI-2 cleanup schedule and cost.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 20 Jul 1982. 17p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

This report responds to the following questions of Rep. Manuel Lujan, Jr.'s March 8, 1982, letter: slippage of TMI-2 cleanup effort, cost and source of funding for TMI-1 steam generator repair, impact of TMI-2 budget on funds for TMI-1, GPU's financial commitments, and adequacy of August 1981 cleanup cost estimate. (DLC)

12394 **(GEND—012) Feasibility of vitrifying EPICOR II organic resins.** Buelt, J.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC07-76ID01570. 15p. NTIS, PC A02/MF A01. Order Number DE83002733.

Funded by the US Department of Energy under the EG and G/TMI Waste Immobilization Program, Pacific Northwest Laboratory (PNL) has completed the first phase of a program in which a process designed to destroy EPICOR II resins was tested for its feasibility. These resins were utilized to remove cesium and strontium from radioactively contaminated water in the Auxiliary Building at the Three Mile Island Unit 2 Reactor after the incident in March 1979. They are also being used as a polishing system for water processed through the submerged demineralized systems. In a single step, the PNL process greatly reduces the volume of these resins by incinerating them and incorporating cesium, strontium and residual ash particles into glass. The objective of the first phase of the program was to develop and test the concept on a laboratory scale using resins loaded with simulated radionuclides. During the test, a stable glass product was produced in a canister 38 cm tall x 15 cm in dia. This report describes the process development and nonradioactive test results. The report concludes that EPICOR II resins can be destroyed in a single step with minimal waste byproducts.

12395 **(GRS-A—658) Analysis of hypothetical accidents in fast breeder reactors. Part III. Supplementary analysis of coolant disruption for Mark 1A burned-up core of the SNR-300 with the SAS 3D computer program.** Javeri, V.; Lugenheim, V. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Dec 1981. 95p. (In German). Gesellschaft fuer Reaktorsicherheit, Glockengasse 2 . 5000, Koeln, Germany.

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A study is made of the preliminary phase of coolant flow disruption in a failed shutdown system for a burned-up core of the SNR reactor. Data are presented on pump flow characteristics and Doppler, fuel, and sodium void reactivity effects. 11 references, 13 tables.

12396 **(GRS-A—661) Calculations for LOFT experiment L3-1 with the homogeneous version of the computer code DRUFAN.** Schally, P.J. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). Dec 1981. 68p. (In German). Gesellschaft fuer Reaktorsicherheit, Forschungsgelaende, 8046 Garching, Germany.

Calculations with the computer code DRUFAN01 for the small break LOFT experiment L3-1 have been performed within the framework of the research project RS 182 Beteiligung an dem LOFT-Programm der USNRC. The LOFT experiment L3-1 simulated a 2.5% break in the cold leg of a PWR, where the high pressure injection rate was smaller then the break flow rate. Analysis showed the following results: The code DRUFAN01 which is based on homogeneous phase distribution within a node has only limited capabilities for the simulation of small breaks. Therefore, the code version DRUFAN-02, based on an inhomogeneous model should be applied. ECC injections with larger mass flow rates result in high computing times because of condensation and water packing. The developed LOFT model is a good basis for the simulation of other transients.

12397 **(GRS-A—666) First comparison of the results of standard problems carried out in the blowdown region.** Winkler, W.; Ritzinger, W. (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Garching (Germany, F.R.)). Jan 1982. 63p. (In German). Gesellschaft fuer Reaktorsicherheit (GRS)mbH, Garching, Germany.

In the first step, in this report the results of 6 international Standard Problems are compared. They have been performed during 1977 and 1980 and are based on 4 integral blowdown-tests under Pressurized Water Reactor conditions with double-ended 200 %-break within 3 test facilities of different scale. In figures most of the selected, possibly safety-relevant parameters are presented with scales directly comparable and with exceptions as shaded areas for the participants' calculations. To obtain best-estimate results a total of 51 blind pre- or open post-calculations were performed by 45 participants out of 26 organizations of 10 countries, using 10 computer programs and numerous modifications and updates of them.

12398 **(HEDL-SA—2790) Calibration of SSTR neutron dosimetry for TMI-2 applications.** Gold, R.; Ruddy, F.H.; Roberts, J.H.; Preston, C.C.; Ulseth, J.A.; McElroy, W.N.; Leitz, F.J.; Hayward, B.R.; Schmittroth, F.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 30 Sep 1982. Contract AC06-76FF02170. 29p. (CONF-820762—1). NTIS, PC A03/MF A01. Order Number DE83004073.

From 5. meeting of the Pacific Northwest working Group on nuclear track registration; Richland, WA, USA (28 Jul 1982).

Application of neutron dosimetry for assessment of fuel distribution throughout the Three Mile Island-2 (TMI-2) reactor-core region and the primary-coolant system is advanced. Neutron dosimetry in the reactor cavity, i.e. the cavity between the pressure vessel and the biological shield, could provide data for the assessment of the core fuel distribution. A more immediate task entails locating and quantifying the amount of fuel debris in the ex-core primary coolant system; in the range of 1 to 1000 kg. Solid-state track-recorder (SSTR) neutron dosimetry is considered for such exploratory scoping experiments at TMI-2. The sensitivity of mica-^{235}U (asymptotically thick) SSTR has been ascertained for such environments. It has been demonstrated that the SSTR method has adequate sensitivity to properly respond and detect fuel quantities of the order of 1 kg in the ex-core primary coolant system. 21 figures.

12399 **(INFO—0052) Methodology for the inspection of items important to safety. The Canadian approach.** Ishack, G. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Nov 1981. 18p. (CONF-8111119—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703383.

From IAEA seminar on safety review and inspection of nuclear power plants; Vienna, Austria (23 Nov 1981).

A description is given of the inspection methods adopted by the Canadian Atomic Energy Control Board. From the outset of the industry in Canada, resident officers have been assigned to nuclear power stations. These inspectors have unlimited access to equipment, documents and personnel at the station. They work closely with Head Office specialists, provincial authorities, and private consultants.

12400 **(INFO—0056) Report on the use of programmable digital computers in the shutdown systems of the Darlington G.S.** (Atomic Energy Control Board, Ottawa, Ontario (Canada). Advisory Committee on Nuclear Safety). Jun 1981. 4p. (ACNS—3). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703344.

This report considers the use of large, programmable computers in the shutdown system at the planned Darlington Generating Station. After a review of the document submitted to the Atomic Energy Control Board (AECB) by Atomic Energy of Canada Ltd. Engineering Company in support of gaining AECB's agreement in principle to such a system, the ACNS concludes that no fundamental principle will be challenged by the introduction of computer technology into safety systems. It cautions, however, that the AECB should ensure that existing principles particularly those of independence and redundancy, will not be compromised in the application.

12401 **(INIS-mf—7038) Particular aspects and limits of absolute nuclear liability.** Engelhard, M.; Brunengo, C. (International Nuclear Law Association (INLA), Brussels (Belgium)). Oct 1981. 13p. (In French). (CONF-8109120—24). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82780782.

From Nuclear International Jura '81; Palma de Mallorca, Spain (27 Sep 1981).

Ambiguities subsist concerning the application limits of conventional non-nuclear liability and nuclear liability. Based on three examples where the system of channelling liability onto the operator of a nuclear installation is not applied: holder of low-risk nuclear products or materials; nuclear/supplier contractual relations; and nuclear operator/third party relations, this paper outlines some practical solutions to the problems met. The solutions considered concern: suppression of nuclear risk exclusions in policies underwritten by persons who do not take part in the nuclear activity and generalizing and strengthening of the channelling of the nuclear risk onto the operator as well as creation of "bridges" between the existing Conventions.

12402 **(IS-M—384) Simplified analysis of shells with local, impulsive loads.** Fanous, F.S.; Greimann, L.F. (Ames Lab., IA (USA)). 1982. Contract W-7405-ENG-82. 27p. (CONF-820633—7). NTIS, PC A03/MF A01. Order Number DE83003791.

From Workshop on containment integrity for nuclear power reactors; Arlington, VA, USA (7 Jun 1982).

The response of axisymmetric shells to localized impulsive loadings that produce large deformations and material nonlinearities are analyzed. Simplified methods for the prediction of the strain ductility of these shells are presented. The methods are developed by idealizing the structure as a single degree of freedom model. Large deformation effects are included and an elastic-perfectly plastic material model is used. Several impulsive problems are analyzed using a finite element technique and the simplified solution. The agreement between the two results indicates that the simplified methods provide an accurate solution at a fraction of the cost of the finite element solution. 10 figures.

12403 **(KFK—3292) Results of research and development activities in 1981 of the Institute for Reactor Components.** (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Feb 1982. 31p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750943.

Besides thermo- and fluid dynamic problems of reactor engineering, such as two-phase mass flow measuring technique and behaviour of core melts and pebble beds, most work was done on the safety of nuclear facilities. To this purpose, investigations on the evidence of incidents of the sodium-cooled fast breeder, emergency core cooling of the advanced pressurized water reactor, and the liquid metal target of the spallation neutron source have been carried out in particular.

12404 **(NUREG—0011-Suppl.6) Safety evaluation report related to the operation of Sequoyah Nuclear Plant, Units 1 and 2, Docket Nos. 50-327 and 50-328, Tennessee Valley Authority.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1982. 43p. NTIS, PC A03/MF A01 - GPO $4.75. Order Number DE83900976.

Supplement No. 6 to the Safety Evaluation Report (SER) related to the operation of the Tennessee Valley Authority's Sequoyah Nuclear Plant, Units 1 and 2, located in Hamilton County, Tennessee, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The purpose of this supplement is to update the staff's evaluations of the issues related to the hydrogen mitigation system identified in the SER and previous supplements as needing resolution.

12405 **(NUREG—0606-Vol.4-No.4) Unresolved safety issues summary: aqua book.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Dec 1982. 80p. NTIS, PC A05/MF A01 - GPO. Order Number DE83900592.

The unresolved safety issues summary is designed to provide the management of the Nuclear Regulatory Commission with a quarterly overview of the progress and plans for completion of generic tasks addressing unresolved safety issues reported to Congress pursuant to Section 210 of the Energy Reorganization Act of 1974 as amended. This summary utilizes data collected from the Office of Nuclear Reactor Regulation, Office of Nuclear Regulatory Research, and the National Laboratories and is prepared by the Office of Resource Management. The schedules in this book include a milestone at the end of each action plan which represents the initiation of the implementation process both with respect to incorporation of the technical resolution in the NRC official guidance or requirements and also the application of changes to individual operating plants. The schedule for implementation will not normally be included in the task action plan(s) for the resolution of a USI since the nature and extent of the activities necessary to accomplish the implementation cannot normally be reasonably determined prior to the determination of a technical resolution. The progress and status for implementation of unresolved safety issues for which a technical resolution has been completed are reported specifically in a separate table provided in this summary.

12406 **(NUREG—0783) Suppression-pool temperature limits for BWR containments.** Su, T.M. (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Nov 1981. 39p. NTIS, PC A03/MF A01 - GPO $3.00. Order Number DE83900908.

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Boiling water reactor (BWR) plants are equipped with safety/relief valves (SRVs) to protect the reactor from overpressurization. Plant operational transients, such as turbine trips, will actuate the SRV. Once the SRV opens, steam released from the reactor is discharged through SRV lines to the suppression pool in the primary containment. Steam is then condensed in the suppression pool in a stable condition. Extended steam blowdown into the pool, however, will heat the pool to a level were the condensation process may become unstable. This instability of steam condensation may cause severe vibratory loads on containment structures. Current practice in dealing with this phenomenon restricts the allowable operating temperature envelope of the pool in the Technical Specifications so that this instability will not occur. This restriction is referred to as the pool temperature limit. Task Action Plan (TAP) A-39, Determination of Safety/Relief Valve (SRV) Pool Dynamic Loads and Temperature Limits for BWR Containment, was established to resolve, among other things, the concern about steam condensation behavior for the Mark I, II, and III containments. This report presents the resolution of this issue and includes: (1) the acceptance criteria related to the suppression pool temperature limits; (2) events for which a suppression pool temperature response analysis is required; (3) assumptions used for the analysis; and (4) requirements for the suppression pool temperature monitoring system. This report completes the subtask related to the suppression pool temperature limit in TAP A-39.

12407 **(NUREG—0820) Intergrated plant safety assessment. Systematic evaluation program. Palisades plant, Consumers Power Company, Docket No. 50-255. Final report.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Oct 1982. 529p. NTIS (US Sales Only) - GPO $12.00. Order Number DE83900458.

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The Nuclear Regulatory Commission (NRC) has published its Final Integrated Plant Safety Assessment Report (IPSAR) (NUREG-0820), under the scope of the Systematic Evaluation Program (SEP), for Consumers Power Company's Palisades Plant located in Covert, Van Buren County, Michigan. The SEP was initiated by the NRC to review the design of older operating nuclear reactor plants to reconfirm and document their safety. This report documents the review completed under the SEP for the Palisades Plant. The review has provided for (1) as assessment of the significance of differences between current technical positions on selected safety issues and those that existed when the Palisades Plant was licensed, (2) a basis for deciding on how these differences should be resolved in an integrated plant review, and (3) a documented evaluation of plant safety when all supplements to the Final IPSAR and the Safety Evaluation Report for converting the license from a provisional to a full-term license have been issued. The report also addresses the comments and recommendations made by the Advisory Committee on Reactor Safeguards in connection with its review of the Draft Report, issued in April 1982.

12408 **(NUREG—0912) Safety evaluation report related to the renewal of the operating license for the Worcester Polytechnic Institute open-pool training reactor, Docket No. 50-134.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1982. 67p. NTIS, PC A04/MF A01 - GPO $5.00. Order Number DE83900707.

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This Safety Evaluation Report for the application filed by the Worcester Polytechnic Institute (WPI) for a renewal of Operating License R-61 to continue to operate the WPI 10-kW open-pool training reactor has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The facility is owned and operated by the Worcester Polytechnic Institute and is located on the WPI campus in Worcester, Worcester County, Massachusetts. The staff concludes that the reactor facility can continue to be operated by WPI without endangering the health and safety of the public.

12409 **(NUREG/BR—0051-Vol.4-No.4) Power reactor events.** Massaro, S.A. (ed.). (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Nov 1982. 33p. NTIS, PC A03/MF A01 - GPO. Order Number DE82905921.

This is a bi-monthly newsletter that compiles operating experience information about commercial nuclear power plants. This includes summaries of noteworthy events and listings and/or abstracts of USNRC and other documents that discuss safety-related or possible generic issues. It is intended to feed back some of the lessons learned from operational experience to the various plant personnel, i.e., managers, licensed reactor operators, training coordinators, and support personnel.

12410 **(NUREG/CR—2000-Vol.1-No.11) Licensee event report (LER) compilation for the month of November 1982.** (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 123p. (ORNL/NSIC—200-Vol.1-No.11). NTIS, PC A06/MF A01 - GPO $6.00. Order Number DE83004686.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting are described in detail in NRC Regulatory Guide 1.16 and NUREG-0161, Instructions for Preparation of Data Entry Sheets for Licensee Event Reports. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, and keyword indexes follow the summaries. The components and systems are those identified by the utility when the LER form is initiated; the keywords are assigned by the NSIC staff when the summaries are prepared for computer entry.

12411 **(NUREG/CR—2526) LOCA simulation in NRU program. Data report for thermal-hydraulic experiment 2 (TH-2).** Mohr, C.L.; Hesson, G.M.; King, L.L. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 150p. (PNL—4164). NTIS (US Sales Only), PC A07/MF A01 - GPO $6.50. Order Number DE83004298.

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A series of thermal-hydraulic and cladding material experiments are being conducted using light-water-reactor fuel bundles as part of the Pacific Northwest Laboratory Loss-of-Coolant Accident (LOCA) Simulation Program. Experimental data and initial results from the fourth experiment in the program - thermal-hydraulic experiment 2 (TH-2) - are presented in this report. The program is being conducted in the National Research Universal (NRU) reactor, Chalk River, Ontario, Canada. A full-length test bundle containing nonpressurized-water-reactor fuel rods was used to develop reflood control parameters and procedures that will produce a reduced heatup rate or a flat top transient for extended periods of time. Variable reflood rates were used, and experimentally determined control-system-logic parameters were developed. Using these concepts, fuel-cladding temperatures from 1033 to 1274K (1400 to 1834°F) were produced for 283 s.

12412 **(NUREG/CR—2558) CONTEMPT 4/MOD 3: a multicompartment containment system analysis program.** Cheng, T.C.; Metcalfe, L.J.; Hartman, J.E.; Mings, W.J.; Crail, A.C. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1982. 209p. (EGG—2159). NTIS, PC A10/MF A01 - GPO $7.50. Order Number DE83900721.

CONTEMPT4/MOD3 is a digital computer program, written in FORTRAN IV, that describes the behavior of multicompartment pressurized water reactor (PWR) containment systems and experimental containment systems subjected to postulated loss-of-coolant accident (LOCA) conditons. The program calculates the time variation of compartment pressures, temperatures, mass and energy inventories, heat structure temperature distributions, and intercompartment mass and energy exchange based on user-supplied values for compartment descriptions, time step and edit controls, and selected problem features. Analytical models available to describe containment systems include models for containment fans and pumps, cooling sprays, fan coolers, heat-conducting structures, sump drains, and PWR ice condensers. Dynamic stroage allocation (DSA) is used to limit the amount of computer core used for each problem. Optional automatic time step control allows the code to determine time step sizes within limits dictated by the user. Multicompartment capability (up to 999 individual compartments) and generalized, user-oriented input-data descriptions permit improved flexibility over previous codes in the CONTEMPT series. Analytical model descriptions, input instructions, and sample problem results are presented.

12413 **(NUREG/CR—2601-Vol.1) Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents.** Murphy, E.S.; Holter, G.M. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 459p. NTIS, PC A20/MF A01 - GPO $13.00. Order Number DE83004428.

Technical requirements, costs, and safety are conceptually evaluated for the post-accident cleanup and decommissioning of light water reactors. The initial effort following a reactor accident is to bring the plant under control and to stabilize the reactor to prevent further accidents. Stabilization of the reactor is followed by accident cleanup and by decommissioning or refurbishment of the facility. This study provides an analysis of accident cleanup and decommissioning activities for three postulated accident scenarios. The scenario 1 accident is postulated to result in 10% fuel cladding failure, no fuel melting, moderate contamination of the containment structure, but no significant physical damage to buildings and equipment. The scenario 2 accident is postulated to result in 50% fuel cladding failure, a small amount of fuel melting, extensive radioactive contamination of the containment structure, moderate radioactive contamination of supporting buildings, and minor physical damage to buildings and equipment. The scenario 3 accident is postulated to result in 100% fuel.cladding failure, significant fuel melting and core damage, severe radioactive contamination of the containment structure, moderate radioactive contamination of supporting buildings, and major physical damage to structures and equipment.

12414 **(NUREG/CR—2701) Assessment of fuel-foaming potential during core-meltdown accidents.** Cronenberg, A.W.; Croucher, D.W.; MacDonald, P.E. (Idaho National Engineering Lab., Idaho Falls (USA)). Oct 1982. Contract AC07-76ID01570. 54p. (EGG—2191). NTIS, PC A04/MF A01 - GPO. Order Number DE83003925.

Fuel melting during severe core-damage accidents can be expected to lead to the rapid release of fission gas from the fuel matrix and the volatilization of low-boiling-point metallic inclusions, which can significantly influence molten-fuel swelling/foaming behavior. A quantitative analysis of UO_{21} foaming potential is therefore presented, based on an assessment of the time characteristics of bubble growth, surface escape, film thinning, and bubble coalescence. Analysis indicates that although the potential exists for early molten UO_2 foaming, such foams are basically unstable and tend to collapse, thereby releasing volatilized fission products from the molten-fuel debris. Release of such fission products will impact not only the course of melt progression during a meltdown accident, but also the radiological source term, and can result in as much as a 30 to 40% reduction in the residual debris decay heat level. In addition, such foam collapse indicates that the molten-core debris can be expected to be relatively dense, which will impact debris-cooling characteristics.

12415 **(NUREG/CR—2825) BWR 4/Mark I accident sequences assessment.** Yue, D.D.; Cole, T.E. (Oak Ridge National Lab., TN (USA)). Nov 1982. Contract W-7405-ENG-26. 128p. (ORNL/TM—8148). NTIS, PC A07/MF A01 - GPO. Order Number DE83003396.

This work uses the MARCH computer code to investigate the major events that may occur at a BWR 4/Mark I nuclear power plant following a number of postulated transients. These events are, in turn, correlated to the Nuclear Regulatory Commission Emergency Action Level Guidelines. The Browns Ferry Nuclear Plant Unit 1 was used as a model in this study. Under the assumptions used in this study, all accident sequences analyzed would eventually result in core-melt and containment breach unless the operator took corrective action. In each sequence, the effect of parameter variations on the accident progression has also been investigated. Results of this study show that in most core meltdown sequences overtemperature in the drywell electric penetration assembly (EPA) seals would be the dominant failure mode except for sequences TW, S_2I, and S_2J, in which there is a total loss of decay heat removal capability, with resultant higher pressure buildup in the containment. For the latter sequences, overpressurization would be the dominant containment failure mode.

12416 **(NUREG/CR—2899) Analysis of a proposed one thousand dollar per man-rem cost-effectiveness criterion.** Strip, D.R. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 9p. (SAND—82-1870). NTIS, PC A02/MF A01 - GPO. Order Number DE83004010.

The Nuclear Regulatory Commission has proposed a one-thousand-dollar per man-rem averted ALARA criterion. This report examines the relationship between population dose and health effects, as well as onsite and offsite damage. Examination of the consequences of potential accidents at two sites shows that a site with lower population dose can have equal or greater consequences in terms of health effects and property damage. Using predicted consequences of potential accidents at 156 reactor-site combinations, the dependence of population dose and consequences is examined and its implications discussed.

12417 **(NUREG/CR—3040) Selected review of foreign safety research for nuclear power plants.** Stevenson, J.D.; Thomas, F.A. (Stevenson and Associates, Cleveland, OH (USA)). Nov 1982. 119p. NTIS, PC A06/MF A01 - GPO $6.00. Order Number DE83900031.

Portions of document are illegible.

A compilation and description of current foreign research related to regulatory standards and licensing issues in areas of interest associated with Siting, Structural Engineering, Metallurgy and Materials, and Mechanical Engineering are presented. Also included in this report and summary is a discussion of those research areas in

which there exists a potential for joint sponsorship by the US NRC. The particular foreign countries surveyed are Canada, France, Japan, Sweden, United Kingdom of Great Britain and Northern Ireland, and the Federal Republic of Germany.

12418 **(PNL-SA—9990) Comprehensive (MORT based) approach to planning internal decontamination.** Munson, L.F.; Witt, F.J. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1982. Contract AC06-76RL01830. 24p. (CONF-820973—1). NTIS, PC A02/MF A01.

From International conference on decontamination of nuclear facilities; Niagara Falls, Canada (19 Sep 1982).

Portions of document are illegible.

A modified MORT (management oversight risk tree) method has been used to identify the elements that are necessary for a successful restorative decontamination of a typical light water reactor. The established criteria for successful planning in key areas is referenced.

12419 **(SAND—82-2186C) Hydrogen production during fragmented debris/concrete interactions.** Tarbell, W.W.; Blose, R.E. (Ktech Corp., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 18p. (CONF-821026—11). NTIS, PC A02. Order Number DE83001268.

From 2. international workshop on the impact of hydrogen on water reactor safety; Albuquerque, NM, USA (3 Oct 1982).

PC only, illegibility does not permit Mf reproduction.

In the unlikely event that molten core debris escapes the reactor pressure vessel, the interactions of the debris with concrete and structural materials become the driving forces for severe accident phenomena. The Ex-vessel Core Debris Interactions Program at Sandia Laboratories is a research effort to characterize the nature of these interactions and the magnitude of safety-related phenomena such as hydrogen generation, aerosol production, and fission product release that arise because of the melt/concrete interactions.

12420 **(UCRL—83045) Fluid-structure-coupling algorithm.** McMaster, W.H.; Gong, E.Y.; Landram, C.S.; Quinones, D.F. (Lawrence Livermore National Lab., CA (USA)). Jan 1980. Contract W-7405-ENG-48. 6p. (CONF-800804—13). NTIS, PC A02/MF A01. Order Number DE83005510.

From ASME century 2 emerging technology conference; San Francisco, CA, USA (10 Aug 1980).

A fluid-structure-interaction algorithm has been developed and incorporated into the two dimensional code PELE-IC. This code combines an Eulerian incompressible fluid algorithm with a Lagrangian finite element shell algorithm and incorporates the treatment of complex free surfaces. The fluid structure, and coupling algorithms have been verified by the calculation of solved problems from the literature and from air and steam blowdown experiments. The code has been used to calculate loads and structural response from air blowdown and the oscillatory condensation of steam bubbles in water suppression pools typical of boiling water reactors. The techniques developed here have been extended to three dimensions and implemented in the computer code PELE-3D.

12421 **ACRS review of the 1983 NRC Safety Research Program.** *Nuclear Safety;* **23**: No. 5, 515-520(Sep-Oct 1982).

This article provides a review of the Nuclear Regulatory Commission (NRC) Safety Research Program for FY 1983. The NRC Safety Research Program support funding is $196.6 million in FY 1982, and the proposed budget for FY 1983 is $195.2 million. The requested level of funding for FY 1982, recommended by the ACRS and partially accepted by the NRC, was reduced significantly by the Congress in response to the administration's budget-reduction program. At the same time, the Congress directed a delay in the timing of the LOFT phaseout. This review of the FY 1983 program again focuses on priorities in research and recommends certain reallocations of funds. If the funding for LOFT is increased from that in the proposed budget, based on the current schedule for phaseout, many of the actions recommended in this review should be reexamined.

12422 **DOE plans for LWR safety research.** *Nuclear Safety;* **23**: No. 5, 520-524(Sep-Oct 1982).

Congress passed Public Law 96-567, Nuclear Safety Research, Development, and Demonstration Act of 1980 (hereafter referred to as the Act), to provide for an accelerated and coordinated program of light-water-reactor (LWR) safety research, development, and demonstration to be carried out by the Department of Energy (DOE). On the basis of an evaluation of this input, it is concluded that DOE's ongoing LWR safety program is responsive to the Act. Specifically, the program includes tasks in the areas of regulatory assessment, risk assessment, fission-product source term, and emergency preparedness as well as providing technical assistance to the Institute of Nuclear Power Operations (INPO) to improve training of nuclear power personnel. These very high priority efforts were identified as necessary and appropriate for support by DOE.

12423 **Physical phenomena of a small-break loss-of-coolant accident in a PWR.** Burchill, W.E. (Combustion Engineering, Inc., Windsor, CT). *Nuclear Safety;* **23**: No. 5, 525-536(Sep-Oct 1982).

The physical phenomena that occur during a small-break loss-of-coolant accident (LOCA) in a pressurized-water reactor (PWR) are described. The influence of various PWR design parameters on the consequences of small-break LOCAs is discussed. Classes of small-break LOCAs are defined based on break area. Both pictorial and graphical illustrations are provided.

12424 **Recent advances in evaluation of BWR loss-of-coolant accident.** Beckner, W.D. (Nuclear Regulatory Commission, Washington, DC). *Nuclear Safety;* **23**: No. 5, 537-548(Sep-Oct 1982).

Recent research investigating the boiling-water-reactor (BWR) loss-of-coolant accident (LOCA) is summarized. This review includes some of the major BWR experimental research and code development sponsored in the United States by the Nuclear Regulatory Commission, the Electric Power Research Institute, and the General Electric Company. The relationship between US research and that conducted in other countries is also included. This work has shown that there is a large margin in the LOCA calculations performed for the licensing of BWRs. The research on the BWR LOCA has shown the importance of: (1) a countercurrent flow limit at the bundle inlet; (2) cooling of the bundle by steam; (3) flow through leakage paths; and (4) multidimensional effects. Significant progress has been made in our ability to confidently calculate the consequences of BWR LOCAs and other transients.

12425 **Neutronics analysis of Browns Ferry 3 partial control rod insertion.** Chexal, V.K. (Nuclear Safety Analysis Center, Palo Alto, CA); Layman, W.H.; Carmichael, L.A.; Zolotar, B.A. *Nuclear Safety;* **23**: No. 5, 572-577(Sep-Oct 1982).

This article summarizes results of a reactor neutronic analysis of the incomplete control rod insertion at the Browns Ferry Nuclear Power Station, Unit 3. The analysis focuses primarily on the power distribution in the core and on reactor criticality following failure of some control rods to insert fully after the first scram actuation. The analysis of the incident is based on the established sequence of events, the plant data, and the interpretation of instrumentation responses. The analysis also addresses the effects of initial core-power level on this transient.

12426 **Events resulting in reactor shutdown and their causes.** Mays, G.T.; Gallaher, R.B. (comps.). *Nuclear Safety;* **23**: No. 5, 587-588(Sep-Oct 1982).

The Licensee Event Reports (LERs) received at the Nuclear Safety Information Center (NSIC) from April 22 to June 23, 1982, were reviewed, and events that involved a reactor shutdown are listed. Both operating research reactors and operating commercial power reactors were considered.

12427 **Selected safety-related events reported in May and June 1982.** Casto, W.R. (comp.). *Nuclear Safety;* **23**: No. 5, 589-592(Sep-Oct 1982).

Of the incidents reported during May and June 1982, four are reviewed because of their uniqueness and general interest. A sodium leak occurred at the French fast breeder reactor, Phenix;

Salem 2 recovered from an interesting operational upset; a grid transient initiated by Turkey Point 3 caused an extensive loss of electrical service; and Zion 2 had a simultaneous failure of three auxiliary feedwater pumps.

12428 **General administrative activities.** Cottrell, W.B. (comp.). *Nuclear Safety;* **23**: No. 5, 603-616(Sep-Oct 1982).

Significant safety-related activities reported during May and June, which are not covered elsewhere in this issue, are summarized. The Advisory Committee on Reactor Safeguards (ACRS) issued several reports on a variety of topics of current concern to the Nuclear Regulatory Commission (NRC). Both the ACRS and Scientists and Engineers for Secure Energy (SE_s) comments on safety goals are excerpted. Five speeches by various NRC Commissioners are summarized. A House Committee conducted a hearing on the pressure-vessel thermal shock question. Proposed regulations dealing with Licensee Event Reports (LERs) and mandatory property insurance are reviewed. Last is a listing of a variety of safety-related topics.

12429 **Reports, standards, and safety guides.** Silver, E.G.; Queener, D.S. *Nuclear Safety;* **23**: No. 5, 617-624(Sep-Oct 1982).

This article contains four lists of various safety-related documents as compiled by the editors. These lists are as follows: (1) Foreign Reports; (2) Other Reports (originated by and pertaining to the US nuclear community); (3) Regulatory Guides; and (4) Nuclear Standards. Each list contains the documents in its category which were published (or became available) during the 2-month period (May-June 1982) covered by this issue of Nuclear Safety. The availability and cost of the documents are noted in most instances.

12430 **Impact of source term assumptions on reactor accident consequences.** Ostmeyer, R.M.; Alpert, D.J. (Sandia, Albuquerque, NM). *Transactions of the American Nuclear Society;* **41**: 410-412(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12431 **Emergency planning: life protection or ALARA.** Hull, A.P. (BNL, Upton, NY). *Transactions of the American Nuclear Society;* **41**: 424-425(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12432 **SEM-TEM Sampling technique for use with fuel LWR cladding.** Yaggee, F.L. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **41**: 248(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12433 **Incorporation of various uncertainties in dependent failure probability estimation.** Samanta, P.K.; Mitra, S.P. (Brookhaven National Laboratory, Upton, NY 11973). *Transactions of the American Nuclear Society;* **41**: 184-185(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12434 **Degraded core studies at INEL.** Buescher, B.J.; Howe, T.M.; Miller, R.W. (EG&G Idaho Inc., P.O. Box 1625, Idaho Falls, ID 83415). *Transactions of the American Nuclear Society;* **41**: 456-457(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12435 **Analysis of LWR degraded core accidents.** Maudlin, P.J.; Schwegler, E.C.; Tomkins, J.L. (SLANL, Los Alamos, CA). *Transactions of the American Nuclear Society;* **41**: 412-413(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12436 **Formation of dry pockets during water penetration into a hot particle bed.** Armostrong, D.R.; Bova, L.; Cho, D.H. (ANL, Argonne, IL). *Transactions of the American Nuclear Society;* **41**: 418-419(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12437 **Degraded core aspects of Sandia's probabilistic and cost-benefits programs.** Benjamin, A.S. (Sandia National Laboratories, Albuquerque, NM 87185). *Transactions of the American Nuclear Society;* **41**: 455-456(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12438 **Dose levels and neutron reaction rates for HPRR and SHEBA.** Renier, J.P.; Knight, J.R.; Westfall, R.M. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **41**: 502-504(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12439 **The integrity of PWR pressure vessels during overcooling accidents.** Cheverton, R.D.; Iskander, S.K.; Whitman, G.D. (Oak Ridge National Laboratory, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **41**: 258-259(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12440 **CRBRP radiation protection ALARA program.** Baker, J.C.; Brown, S.L. (WARD, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society, Supplement;* **41**: 36-37(1982). (CONF-820307—).

From Topical meeting on engineering for nuclear plant construction, operation, and maintenance; Charleston, SC, USA (28 Mar 1982).

12441 **Development and application of a methodology for the analysis of significant human related event trends in nuclear power plants.** Cho, H.Y. Ames, IA; Iowa State Univ. (1981). 254p. University Microfilms Order No.82-09,108.

Thesis (Ph.D.).

A methodology is developed to identify and flag significant trends related to the safety and availability of U.S. commercial nuclear power plants. The development is intended to aid in reducing likelihood of human errors. To assure that the methodology can be easily adapted to various types of classification schemes of operation data, a data bank classified by the Transient Analysis Classification and Evaluation (TRACE) scheme is selected for the methodology. The significance criteria for human-initiated events affecting the systems and for events caused by human deficiencies were developed. Clustering analysis was used to verify the learning trend in multidimensional histograms. A computer code is developed based on the K-Means algorithm and applied to find the learning period in which error rates are monotonously decreasing with plant age. The Freeman-Tukey (F-T) deviates are used to select generic problems identified by a large positive value (here approximately over 2.0) for the deviate. The identified generic problems are: decision errors which are highly associated with reactor startup operations in the learning period of PWR plants (PWRs), response errors which are highly associated with Secondary Non-Nuclear Systems (SNS) in PWRs, and significant errors affecting systems and which are caused by response action are highly associated with startup reactor mode in BWRS.

12442 **UW-4F: a mechanistic four-fluid two-phase flow model for LOCA analysis during reflood.** Summers, R.M. Madison, WI; Univ. of Wisconsin (1981). 344p. University Microfilms Order No.81-29,806.

Thesis (Ph.D.).

In this thesis, a mechanistic, four-fluid, two-phase flow model, UW-4F, for analysis of the reflood stage of a Loss-of-Coolant Accident has been developed. The two-phase flow is character-

ized as one-dimensional flow in a single subchannel, consisting of four distinct and separate fluids: (1) continuous liquid, (2) continuous vapor, (3) liquid droplets dispersed in the continuous vapor, and (4) vapor bubbles dispersed in the continuous liquid. The thermal-hydraulic behavior of each fluid is described by a complete set of field equations for conservation of mass, momentum, and energy. These equations include interaction terms that describe the exchange of mass, momentum, and energy among the fluids and the subchannel walls which are specified by constitutive equations to close the system.

12443 **Monitors 1980: now there are two.** Grisham, D.L.; Baldwin, T.S.; Ekberg, E.L.; Lambert, J.E.; Madrid, M.A.; Tanner, R.L. (LASL, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **35**: 613-614(Nov 1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12444 **Importance of spatial kinetics in LWR safety analysis.** Diamond, D.J.; Cheng, H.S. (BNL, Upton, NY 11973). *Transactions of the American Nuclear Society;* **35**: 562-564(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12445 **Breeder reactor program T-3 cask.** Krupar, J.J.; Berger, J.D.; Weber, E.T. (DOE-FFTF-PO, Richland, WA 99352). *Transactions of the American Nuclear Society;* **35**: 607-608(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12446 **T-3 cask handling systems at HFEF.** Taylor, D.S.; Berger, J.D.; McClurkin, J.L. (ANL-Idaho, Idaho Falls, ID 60439). *Transactions of the American Nuclear Society;* **35**: 609(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12447 **(RISLEY-Trans—4186) Incidents in German nuclear power stations.** (UKAEA Risley Nuclear Power Development Establishment). [nd]. Translated from Publication of the confidential incident reports of the West German Government by the Federal Association of Citizens' Action Groups for Environental Protection (BBU), September 1979. 196p. NTIS (US Sales Only), PC A09/MF A01. Order Number DE83900452.

In this document, BBU presents a complete list of all the incidents in German nuclear power plants from 1965 to Autumn 1977. The incident list covers Stade, Lingen, Wuergassen, AVR, Biblis A, Obrigheim, MZFR, KNK I, VAK, and Gundremmingen KRB. (DLC)

25 ENERGY STORAGE

2501 Magnetic

12448 **(UCRL—87727) Rotary flux compressor: a new high-power compact energy store.** Carder, B.; Eimerl, D.; Bird, W. (Lawrence Livermore National Lab., CA (USA); Texas Univ., Austin (USA). Center for Electromechanics). 11 Jun 1982. Contract W-7405-ENG-48. 4p. (CONF-820626—14). NTIS, PC A02/MF A01. Order Number DE83004207.

From 15. power modulator symposium; Baltimore, MD, USA (14 Jun 1982).

Capacitors and explosives are the only devices that are traditionally used for storing energy for long periods of time when the need exists to release this energy very rapidly, at very high powers. Rotary energy storages, e.g., flywheels, are also capable of storing energy for reasonably long times (i.e., tens of minutes), but until recently, the minimum discharge times for these stores have been the order of a tenth of a second. This paper discusses a new rotational energy store, the rotary flux compressor, that has produced high-power electrical discharges of less than one millisecond in duration. Computer codes have shown the feasibility of machines that will deliver up to 15 megajoules in single or multiple sub-millisecond impulses. Several types of rotary flux compressors exist, including the Compulsator, the Active Rotary Flux Compressor (ARFC), and the Brushless Rotary Flux Compressor. The ARFC is currently under development at LLNL and the University of Texas. It requires startup energy (via a capacitor), but tests to date demonstrate 15 times more energy delivered by the machine than is stored by the startup capacitor. This paper discusses the conclusions drawn from these tests.

2502 Compressed Gas

12449 **(EPRI-EM—2351-Vol.4) Compressed-air energy storage preliminary design and site-development program in an aquifer. Volume 4. Aquifer geology. Final report.** Walke, W.C.; McCafferty, T.W. (Sargent and Lundy, Chicago, IL (USA); Public Service Co. of Indiana, Inc., Plainfield (USA)). Nov 1982. Contract AC02-78ET29232. 195p. NTIS, PC A09/MF A01. Order Number DE83004003.

Portions of document are illegible.

A study sponsored by DOE and EPRI was performed to investigate the behavior and suitability of aquifers as compressed-air energy storage sites. Volume 4 forms a part of the final report that culminates the work performed in the study. Specifically, Volume 4 provides discussions on suitability of air storage in an aquifer, the geological structure of the study area, a literature review of potential areas of concern that could affect operation of a compressed-air energy storage plant, aquifer testing, Media site geological conditions, and areas of potential risk from air storage in an aquifer. This volume provides the reader with a detailed understanding of aquifer geology and describes the effects of air storage in an aquifer.

2503 Pumped Hydro

12450 **(PNL-SA—7982) Pumped-storage hydroelectric plants with underground lower reservoirs.** Chang, G.C.; Thompson, P.A.; Allen, R.D.; Ferreira, A.; Blomquist, C.A. (Pacific Northwest Lab., Richland, WA (USA); Cleveland State Univ., OH (USA); Rensselaer Polytechnic Inst., Troy, NY (USA); Electric Power Research Inst., West Springfield, MA (USA); Argonne National Lab., IL (USA)). Feb 1980. Contract AC06-76RL01830. 25p. (CONF-800645—3). NTIS, PC A02/MF A01. Order Number DE83002703.

From Special session on nuclear waste disposal; Stockholm, Sweden (23 Jun 1980).

Underground Pumped Hydroelectric Storage (UPHS) is a technique for supplying electric power to meet peak load requirements of electric-utility systems. It will incorporate reversible pump/turbines (or tandem pumps and turbines) and an underground reservoir mined within hard rock. During off-peak periods, low-cost power would be used to pump water stored in the underground reservoir to a surface reservoir, providing a head of 1000 to 2000 m. During the subsequent daytime peak-load periods the surface water would supply hydroelectric power over an 8- to 10-hour period, refilling the lower reservoir after passing through the turbines. The design of a UPHS plant and its equipment, site selection criteria, UPHS economics, and environmental concerns are discussed. Considering the fuel conservation potential of UPHS, the following five efforts are recommended to accelerate UPHS implementation: acquisition of applicable construction and operating experience from surface pumped storage; subsurface stability and design evaluation, especially with respect to penstock and powerhouse; equipment design, development and testing; in-depth economic analysis, and study of influences upon the environment.

2504 Capacitor Banks

12451 **(GEPP-TIS—696) Parametric investigations and other related studies of energy storage type capacitors. Quarterly report.** Packer, W.E. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 1 Dec 1982. Contract AC04-76DP00656. 33p. NTIS, PC A03/MF A01. Order Number DE83003426.

Studies on energy storage capacitors were made to: evaluate the effect that processing temperatures have on voltage breakdown; evaluate three alternatives to the mica-filled epoxy encapsulant; improve winding techniques for multisection capacitors; evaluate the use of doubly metallized capacitor films; and develop standard practice guides for capacitor parameters.

2506 Thermal

12452 **(DOE/ER/10343—04) Fundamental heat-transfer processes related to phase-change thermal-storage media.** Sparrow, E.M. (Minnesota Univ., Minneapolis (USA). Dept. of Mechanical Engineering). Dec 1982. Contract AC02-79ER10343. 12p. NTIS, PC A02/MF A01. Order Number DE83002205.

Research performed between June and December 1982 on fundamental heat transfer processes which occur in phase-change thermal storage systems is described. The research encompasses both freezing and melting, and includes both experiment and analysis. The experimental portion of the work in progress is concerned with phase change which occurs within a closed cylinder or tube. In separate but interrelated freezing and melting experiments, the effect of the inclination of the tube in the gravity field was investigated. For freezing, it was found that despite local variations, the global (i.e., surface-averaged) freezing rate was virtually independent of the inclination of the tube. On the other hand, for melting, different regimes characterized by different melting rates were encountered as a function of the tube inclination. The rate of melting is least when the tube is vertical. At moderate angles relative to the vertical, gravity presses the melting solid against the tube, thereby accelerating the rate at which melting occurs. Numerical solutions obtained with an implicit-explicit finite difference scheme were employed to explore the effects of solid-solid phase transitions on freezing which occurs on a plane wall or on the outside surface of a cylinder. Another focus of the work was to take account of heat transfer at the solid-liquid interface due to natural convection in the adjacent liquid melt. In the presence of interfacial convection, freezing ceases when a critical thickness of the solidified layer is attained. The greater the interfacial convection, the smaller is the critical thickness and the shorter is the time required for its attainment. The heat liberated by the solid-solid transition reduces the thickness of the solidified layer but increases the rate of heat extraction at the cooled wall.

12453 **Aquifier thermal energy storage: a survey.** Tsang, C.F.; Hopkins, D.L. (Lawrence Berkeley Lab., CA). *Geological Society of America, Special Paper;* No. 189, 427-441(1982). (CONF-790284—). Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

The disparity between energy production and demand in many power plants has led to increased research on the long-term, large-scale storage of thermal energy in aquifers. Field experiments have been conducted in Switzerland, France, the United States, Japan, and the People's Republic of China to study various technical aspects of aquifer storage of both hot and cold water. Furthermore, technical, economic, and environmental analyses, regional exploration to locate favorable storage sites, and evaluation and design of pilot plants. Several theoretical and modeling studies are also under way. Among the topics being studied using numerical models are fluid and heat flow, dispersion, land subsidence or uplift, the schemes, buoyancy tilting, numerical dispersion, flow, steam injection, and storage in narrow glacial deposits of high permeability. Experiments to date illustrate the need for further research and development to ensure successful implementation of an aquifer storage system. Areas identified for further research include shape and location of the hydrodynamic and permeability, thermal dispersion, natural regional flow, land subsidence or uplift, thermal pollution, water chemistry, wellbore plugging and heat exchange efficiency, and control of corrosion.

2509 Batteries

REFER ALSO TO CITATION(S) 12651

12454 **(AD-A—118363/1) Investigation of lithium sulfur dioxide (Li/SO2) battery safety hazards – chemical studies. Final report 24 Dec 80-23 dec 81.** Abraham, K.M.; Rupich, M.W.; Pitts, L. (EIC Labs., Inc., Newton, MA (USA)). Apr 1982. 109p. (C—656). NTIS, PC A06/MF A01.

The chemistry associated with the discharge and forced overdischarge of the Li/SO2 cell was investigated in detail. A procedure for the quantitative determination of Li2S2O4 in discharged Li/SO2 cells is described. The amount of Li2S2O4 found in cells discharged to potentials down to zero volt was in very good agreement with the discharge stoichiometry, 2Li + 2SO2 yields Li2S2O4. The Li2S2O4 formed in the carbon cathode was also characterized by infrared, ESCA, and X-ray analyses. A number of organic compounds including CH4 and 3,5-diamino-2,4-hexenenitrile have been identified in forced overdischarged cells. Products identified in cells which vented during forced overdischarge include: CO2, CS2, COS, H2S, CH4, C2H4, C2H2, Li2S, and Li2SO3.

12455 **(AD-A—119150/1) Development of improved separators for alkaline zinc batteries. Final report.** Parkhurst, W.A. (Naval Surface Weapons Center, Silver Spring, MD (USA)). 28 Feb 1982. 18p. NTIS, PC A02/MF A01.

This report is a summary of the development of separator materials for rechargeable alkaline zinc batteries over a seven year period. It summarizes studies performed during the earlier years of polyphenylquinoxaline (PPQ) polymer blends as separator materials. The expense of large scale production and the marginal improvement demonstrated for PPQ blends over existing cellulose-based separator materials led to redirection of the work. The current limited effort in the development of nickel-coated separator materials is described. Because of a lack of funding, the characterization of nickel-coated separator materials was not completed. Further characterization, testing and evaluation of the feasibility of such electrically conductive separator film materials is recommended.

12456 **(AD-A—119297/0) Ambient temperature rechargeable lithium battery. Final report 1 Mar 81-28 Feb 82.** Abraham, K.M.; Natwig, D.L.; Harris, P.B.; Avery, J.W. (EIC Labs., Inc., Newton, MA (USA)). Aug 1982. 102p. NTIS, PC A06/MF A01.

Cr0.5V0.5S2 has been characterized as a useful positive electrode material for rechargeable Li cells. The positive electrode reaction involves intercalation of Li during discharge and deintercalation of Li during recharge. A discharge capacity equivalent to nearly le-/Cr0.5Vo.5S2 has been obtained in early cycles at low rates. The average capacity which could be realized in long-term cycling appears to be 0.7 to 0.8e-/Cr0.5V0.5S2. Laboratory cells exceeded 200 deep discharge cycles. Although Cr0.5V0.5S2 and its Li intercalates are good electronic conductors, optimum rate and rechargeability were found in electrodes with from 15 to 20 wt% carbon. Because of this relatively large amount of carbon, the volumetric energy density achieved in cells has been significantly lower than what was anticipated at the outset of the program. The major objective of the program, development of a technology base for the construction of large rechargeable Li cells, has been accomplished. Cells with theoretical capacities of 10 and 20 Ah have been constructed and tested. In limited cycle tests, these large cells performed as well as laboratory test cells.

12457 **(AD-A—119381/2) Lithium-sulfur dioxide (Li/SO_2) battery safety hazards - thermal studies. Final report 24 Dec 80-5 Mar 82.** Ebner, W.B.; Kim, K.Y.; Venkatasetty, H.V. (Honeywell, Inc., Horsham, PA (USA). Power Sources Center). Mar 1982. 246p. NTIS, PC A11/MF A01.

In this program, the Accelerating Rate Calorimeter (ARC) has been employed to study the thermal and pressure behavior of exothermic reactions occurring in Li/SO2 cells under the conditions of forced overdischarge at ambient temperature, resistive overdischarge at ambient temperature, forced overdischarge at -35

C, and (4) discharge at -35 C. Detected reactions have been characterized in terms of self-heating rate, rate of pressure generation, magnitude of overall heat generation, magnitude of overall pressure rise, and kinetic parameters including activation energy and reaction order. Micro-calorimeter studies determined the heat of reaction for the lithium/acetonitrile reaction to be -54 + or - 1.0 kcal/mole-Li. Lithium/aluminum alloy was found to be unreactive with acetonitrile at ambient temperature. Preliminary investigations were also carried out using FTIR spectroscopy to study the products of electrolyte oxidation on nickel and stainless steel electrodes.

12458 **(BNL—32190) Zinc-electrode morphology in acid-battery electrolytes.** McBreen, J.; Gannon, E. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 5p. (CONF-821211—3). NTIS, PC A02/MF A01. Order Number DE83003959.

From 5. DOE battery and electrochemical contractor's conference; Crystal City, VA, USA (7 Dec 1982).

This work includes an investigation of zinc deposition from both $ZnCl_2$ and $ZnBr_2$ electrolytes. The techniques used are cyclic voltammetry, the potential step method and scanning electron microscopy. Apart from the electrolyte the variables investigated were the substrate (zinc, glassy carbon and pyrolytic graphite), fluorinated surfactants, inorganic additives (Pb^{++}, Br^{+++}) and the superimposition of square wave pulses. Results, which could be fitted to reasonable models, could only be obtained after careful attention was given to electrolyte purity, electrode surface preparation and elimination of the resistance component from the potential measurements. The complexing ion greatly affects the kinetics of zinc deposition. In pure electrolytes the nucleation overvoltage for zinc deposition on glassy carbon was ~ 12mV in 3M $ZnBr_2$ and ~ 17mV in 3M $ZnCl_2$. The kinetics were much faster in $ZnBr_2$ electrolytes. The growth of zinc on glassy carbon could be described by a model that assumes instantaneous nucleation of three dimensional centers and growth under kinetic control. When zinc is deposited on zinc, there is no observable nucleation overvoltage and growth occurs with the simultaneous formation of two dimensional layers and the nucleation and growth of three dimensional centers.

12459 **(DOE/CS/54209—10) Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment.** Hewitt, R.; Bryant, J. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Jul 1982. Contract AI01-78CS54209. 283p. (JPL-PUB—82-91). NTIS, PC A13/MF A01. Order Number DE83003283.

Three full-size developmental batteries were tested with electric vehicles: the Eagle-Picher nickel-iron battery, the Globe ISOA lead-acid battery, and the Westinghouse nickel-iron battery. Constant-speed and driving-schedule tests were done on a chassis dynamometer. Several aspects of battery performance were evaluated, including capacity, recharge efficiency, voltage response, and self-discharge. Each of these three batteries exhibited some strengths and some weaknesses, but the Westinghouse battery was found to have significant limitations in several important areas.

12460 **(DOE/ET/25402—T1) New battery materials. Final report, April 1, 1977-Dec. 31, 1979.** Huggins, R.A. (Stanford Univ., CA (USA). Dept. of Materials Science and Engineering). 1979. Contract AC02-77ET25402. 13p. (COO—4506-5). NTIS, PC A02/MF A01. Order Number DE83004684.

This program was undertaken to explore new materials of potential use in advanced lithium-based battery systems, and to understand and evaluate relevant structural, thermodynamic and kinetic parameters. The work has involved activities in several areas, including studies of potential solid electrolytes or ion-transparent separators, positive electrode materials, and negative electrode materials. Efforts were also undertaken to better understand the mechanisms and kinetics of the processes occurring in electrode materials in such systems, and to develop useful experimental and theoretical methods for such purposes. In addition, a minor amount of effort was devoted to investigations of the properties of a newly-discovered intermediate temperature molten salt and its potential use in lithium-based battery systems.

29 ENERGY PLANNING AND POLICY

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 11808

12461 **(EUR—7641-FR) Harmonizatoin of data banks from energy model EFOM 12C with other Belgian data banks. Final report.** Guilmot, J.F.; Daffe, A. (Universite Catholique de Louvain, Louvain-la-Neuve (Belgium)). 1982. 242p. (In French). European Community Information Service, 2100 M Street, NW, Suite 707, Washington, DC 20037.

An analysis is made of data obtained within the framework of coordinating multinational data from the EFOM 12 model. Particular attention is given to verifying technical coefficients of various procedures. For the most part the data are concerned with solar energy and combustible energy in various industrial and commerial sectors. Tabulated data are given for projected energy consumption through the year 2020 for various energy sources (coal, oil, gas, and nuclear).

12462 **(TENRAC/EDF—009) Community-Level Impacts Projection System (CLIPS). Final report.** Monts, J.K.; Barciss, E.R. (Texas Univ., Austin (USA). Center for Energy Studies). Feb 1979. 170p. NTIS, PC A08/MF A01. Order Number DE83900786.

Portions of document are illegible.

The Community-Level Impacts Projection System includes a set of techniques for providing detailed advance information required for rational planning. The computerized system generates reports which enable the user: to describe the energy development activity in terms of its employment demands and spatial location; to estimate how many in-migrating workers will be required; to estimate the demographic characteristics of the in-migrating workers (e.g., how many elementary school children they will bring); to estimate how many additional secondary employment opportunities (e.g., employment in eating and drinking establishments and grocery stores) will be generated; to estimate what the local area's population levels in various age groups would be both with the project and without it; to estimate community population levels for both the impact case and the baseline case; and to estimate the approximate resource requirements and costs for providing additional municipal facilities and services (e.g., water treatment and distribution, wastewater treatment and collection, gas and electric distribution, police and fire protection, etc.)

12463 **(TENRAC/EDF—021) Feasibility analysis of a regional energy-development bank. Final report.** Hazleton, J.E. (Texas Univ., Austin (USA). Lyndon Baines Johnson School of Public Affairs). 31 Aug 1979. 281p. NTIS, PC A13/MF A01. Order Number DE83900830.

Number of alternative policy mechanisms were considered for accelerating the commercialization of new energy technology and resources that have the potential to contribute significantly to domestic energy production in Texas during the 1980's. Advantages and disadvantages of public versus private sector responsibility for energy research and development are discussed. Factors affecting financial feasibility of an energy development bank are enumerated for coordination with Louisiana, Arkansas, Oklahama and New Mexico. The accelerated development of the synthetic rubber industry is included as an example of success in private firms with substantial government assistance. (PSB)

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 11689, 11781, 11976, 11978, 11979, 12462, 12489, 12509, 13097, 13098, 13099, 13100

12464 **(DOE/AD/11257—T1) Impact of energy pricing upon the Hispanic community.** Martinez, T.M. (California State Univ., Fresno (USA). Dept. of Criminology). 8 Dec 1982. Contract FG01-81AD11257. 177p. NTIS, PC A09/MF A01. Order Number DE83004687.

Portions of document are illegible.

This report concerns how the rising costs of energy has impacted upon the community, rural and urban, concentrating upon the social situation of Hispanics and Anglos in Central California. Truly, the foreign challenge can be overcome with enlightened and innovative public policies, in the tradition of Edison, with a firm basis in research data and analysis. Studies of residential usage is critical to understanding the overall energy consumption picture. Future planning for national energy needs depends heavily upon conservation by the residential sector. Yet, over half the population is composed of non-English speakers, low-income, the elderly and rentals, who typically conserve very little compared to middle and high income groups. If conservation is to be an expected new source of energy in the future, then there is a need for policy-makers to understand and penetrate the populations who should participate more in the national goal of energy independence.

12465 **(DOE/ER—0155) Forecasts of on-site and off-site occupational requirements for energy-construction developments in the United States, 1982 to 2000.** (Tennessee Univ., Knoxville (USA)). Nov 1982. 154p. NTIS (US Sales Only). Order Number DE83004442.

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The Construction Analysis Services (CAS) program operated by the University of Tennessee, Knoxville is a computerized information system which produces state and substate forecasts of construction activity and associated manual occupational requirements for each major component of the construction industry, i.e., residential building construction, nonresidential building construction, nonbuilding construction, and energy construction. Of these major components, the energy sector is unique in that it can be forecasted over a long time horizon because there tend to be long lead times between project announcements and initiation of construction and, in the longer term, various econometric models are available to project future energy demand. Realizing this potential, the Department of Energy has become increasingly interested in not only the construction manual labor requirements necessary to build the energy facilities required for the Nation's growth throughout the remainder of this century but also other labor demand that will be associated with energy development. Therefore, the forecasts in this study include the demand for on-site manual, technical, and nonmanual nontechnical workers (clerical and service workers) who will be required for both the construction and operation/maintenance of forecasted capacity additions (omitting existing capacity employment) to the Nation's energy producing sector in the 1982 to 2000 period. Additionally, new off-site jobs generated by this energy expansion are also estimated using an input/output technique.

12466 **(ORAU—206) Training farmworkers for industrial jobs: a longitudinal study.** Weseman, M.; Preston-Anderson, A. (Oak Ridge Associated Universities, Inc., TN (USA)). Sep 1982. Contract AC05-76OR00033. 44p. NTIS, PC A03/MF A01. Order Number DE83004748.

Long-term impacts on farmworkers enrolled in the Training and Technology (TAT) program during fiscal years 1978-1980 were assessed. Cosponsored by DOE and the US Department of Labor, which is responsible for providing farmworkers with alternatives to agricultural employment, the program enrolled 286 unemployed and/or economically disadvantaged farmworkers with 212 (74 percent) completing the six-month program. Graduates have been employed an average of 71 percent of the time since exit with an average hourly wage of $8,05 at the time of the survey (spring 1982). Eighty-three percent report no farmwork in the post-program period. Findings indicate that program completion has a positive impact on farmworkers' posttraining employment experiences as measured by employment stability and wage increases. All subgroups examined experienced favorable outcomes although women and blacks reported lower employment and wage rates than whites and males. Graduates also reported improvement in quality of life, especially in housing, transportation, and financial stability. The study concludes that training for industrial occupations is an effective strategy for moving migrant and seasonal farmworkers out of the agricultural labor market.

12467 **(TENRAC/EDF—005) Input-output and risk analysis for a regional energy-development bank. Final report.** Weatherby, J.L. Jr.; Kieschnick, R.L. Jr.; Peach, J.T.; Wieferman, J. (Southwest Econometrics, Inc., Austin, TX (USA)). Jul 1979. 111p. NTIS, PC A05/MF A01. Order Number DE83900798.

Measurement of the effects of alternative energy technologies are discussed. The joint use of input/output and risk-decision tree analyses is examined from a theoretical and empirical perspective. Two case studies are presented: (1) windmills for irrigation in the High Plains Region; and (2) low Btu gasification combined with a gas turbine topping cycle for the generation of electricity in the Houston-Galveston Region. Performance and ease of use is evaluated. (PSB)

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 11688, 11980, 12270, 12416, 13029, 13032, 13033, 13051, 13063, 13080, 13100, 13101

12468 **(IFUSP-P—266) Environmental impacts of energy utilization.** Prado, C.P.C. do; Orsini, C.M.Q.; Rodrigues, D.; Barolli, E.; Nogueira, F.R.; Bosco, F.A.R.; Tabacniks, M.H.; Artaxo Netto, P.E. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Apr 1981. 142p. (In Portuguese). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82703378.

A survey is done of the available data on the physical environmental impacts in Brazil, derived from energetic systems such as: petroleum, hydroelectricity, firewood, coal, ethanol, methanol and hydrogen. A critical evalution of these data is done with respect to the preservation of the environment. The necessity of studying the environmental impact of the utilization of ethanol, nuclear fuels and coal is stressed.

12469 **(SAND—82-1222) Approach to E, S, and H assurance programs for institutions. Volume II. Line-organization functions.** Ellingson, A.C.; Trauth, C.A. Jr. (eds.). (Sandia National Labs., Albuquerque, NM (USA)). Sep 1982. Contract AC04-76DP00789. 262p. NTIS, PC A12/MF A01. Order Number DE83004478.

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Environmental, Safety and Health (ES and H) Programs, and possible approaches to their implementation, are described in 17 separate Sandia National Laboratories publications. This is the second of two volumes in which much of this material is collected and condensed in order to facilitate its use. This volume offers quidance for the implementation of ES and H Assurance Programs at the working level of line organizations within institutions.

2904 Natural Resources

REFER ALSO TO CITATION(S) 12488, 13139

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 11738, 12486, 12650

12470 **(CONF-8009170—1) Seven technologies for the eighties.** Mechlin, G. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Labs.). 1980. 14p. American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC.

From American Public Power Association energy management and communications workshop; Myrtle Beach, SC, USA (30 Sep 1980).

Projections and expectations of developments in the physical sciences in the next decade that will have the greatest impacts upon man are discussed. The emerging technologies nominated include lasers, optics, robotics, microprocessors, solar photovoltaics, fuel cells, and coal conversion. (WHK)

12471 **(CRN—82-01) Report of activity.** (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1981. 183p. (In French). Dep. NTIS (US Sales Only), MF A01. Order Number DE83900866.

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Research projects are summarized in the areas of nuclear physics, high-energy physics, and radiation chemistry and radiation physics. Publications and conference papers are listed. (WHK)

12472 **(ZfK—463) Central Institute of Nuclear Research Rossendorf 25 years old.** Hohmuth, K.; Kaun, K.H.; Schmidt, A.; Hennig, K.; Brinckmann, H.F.; Lehmann, E.; Rossbander, W.; Bitterlich, H.; Weibrecht, R.; Fuelle, R. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Dec 1981. 123p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82703065.

A colloquium dedicated the 25th anniversary of the foundation of the Central Institute for Nuclear Research of the GDR Academy of Sciences was held on January, 21st, '81. 13 papers were given which dealt with aspects of the institute's history as well as with modern trends in nuclear and solid state physics, nuclear energy and chemistry, radioisotope production, radiation protection and nuclear information.

12473 **Guiding R and D policy.** Hollander, E. (Electric Power Research Inst., Washington, DC). *EPRI (Electric Power Research Institute) Journal;* 7: No. 9, 26-29(Nov 1982).

Electric Power Research Institute (EPRI) president Floyd Culler is among the participants on an advisory council that helps to guide DOE on research and development issues. Panel reviews analyze DOE policies, priorities, and programs in terms of their adequacy and appropriateness. Members engage in open discussion of the issues, although its advice is often contrary to agency views. A listing of Board members illustrates the group's diversity. (DCK)

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 11851, 11932, 11936, 11942, 12336, 12393, 12416, 12417, 12465

12474 **(K/TD—409) Uranium enrichment.** Wilcox, W.J. Jr. (Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 11 Nov 1982. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01. Order Number DE83004199.

A general discussion of uranium enrichment is presented. Some specifics on gaseous diffusion and gas centrifugation are given.

12475 **(NGD—12-1981-R-O) Comparison of Ontario Hydro's performance with world power reactors, 1981.** Dumka, B.R. (Ontario Hydro, Toronto (Canada)). 15 Apr 1982. 32p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900710.

Portions of document are illegible.

Ontario Hydro's performance in the year 1981 is compared with that of 123 world nuclear-powered reactors rated at 500 MW(e) or greater. Data are extracted from a large variety of publications, as well as correspondence with a number of the utilities. The basis used for this comparison is the gross capacity factor, which is defined as gross unit generation divided by the perfect gross output for the period of interest. The factors utilized in the report may vary slightly with those found elsewhere due largely to the varying assumptions used to select the gross maximum power ratings (MCR (gross)). The Ontario Hydro approach is to use the lowest of the published turbine and generator design ratings, unless the unit has been proven capable of consistently exceeding this value.

12476 **Worldwide nuclear power.** *Worldwide Nuclear Power;* 42(May 1981).

Worldwide Nuclear Power (WNP) is a companion volume to Update. Our objective in the publication of WNP is to provide factual information on nuclear power programs and policies in foreign countries to U.S. policymakers in the Federal Government. Facts about the status of nuclear activities abroad should be available to those who are instrumental in defining the direction of nuclear power in the U.S. WNP is prepared by the Office of Nuclear Energy from reports obtained from foreign embassies in Washington, U.S. Embassies overseas, foreign and domestic publications, participation in international studies, and personal communications. It consists of two types of information, tabular and narrative. Domestic nuclear data is included only where its presence is needed to provide easy and immediate comparisons with foreign data. In general, complete U.S. information will be found in Update.

2907 Transport And Storage

12477 (CONF-811175—, pp 73-82) **Meteorological aspects of the transport of energy.** Ahti, K. (Finnish Meteorological Inst., Helsinki, Finland). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

Some typical examples are described of shortcomings and difficulties with meteorological/climatological data applied to energy transportation and utilization particularly oil and gas. These include shortcomings of the observation network, need for combinations of several parameters, and presentation of climatological data. Meteorological factors affecting energy transportation are then discussed, particularly for arctic and tropical regions. (LEW)

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 12122, 12522, 12542, 12543, 12638, 12642

2910 Conservation

REFER ALSO TO CITATION(S) 12134, 12464, 12508, 12512, 12547, 12548, 12558, 12560, 12565, 12566, 12567, 12577, 12613, 12618

12478 **(NYSERDA—82-19) Assessment of energy conservation opportunities in state-assisted housing.** (Flack and Kurtz, New York (USA); Ehrenkrantz Group, New York (USA); Perkins and Will, New York (USA)). May 1982. 104p. New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, New York 12223.

This study of State-assisted housing was undertaken to determine cost-effective energy conservation measures for twelve sample projects across the State and to extrapolate from the sample to develop costs and benefits of such measures for all State-assisted housing projects. A list of cost-effective energy conservation opportunities (ECOs) was selected for each project by selecting ECOs applicable to the construction type and fuel use under consideration and analyzing the implementation cost and potential energy cost savings for each. The ECO's most commonly recommended for these projects are showerhead flow restrictor devices, weatherstripping, various types of insulation, conversion of exterior and interior lighting to more efficient lamp types, storm windows, and provision of more efficient equipment or controls for heating and cooling equipment. Extrapolation of the results for the sample projects to the entire stock of 291 State-assisted housing projects indicates that implementation of cost-effective energy conservation emasures (with payback periods of seven years or less) would involve a capital investment of ~ $100,000,000 and would result in an annual saving in energy costs of ~ $35,000,000 (in 1981 dollars); such savings would reduce the average annual energy cost in State-assisted housing by ~ 22%. The capital commitment required to carry out a coordinated program of conservation is clearly a sound investment for the future viability of these projects.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 11783, 11789, 11790, 11810, 12461, 12475, 12489, 12490, 12496, 12511

12479 **(ASA-I—38/79) Documentation of initial activities in AGF long-term planning of R+D projects.** Geissler, E. (Arbeitsgruppe Angewandte Systemanalyse in der AGF, Koeln (Germany, F.R.)). Mar 1979. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82750921.

In part I the R+D-projects, use of means and thematic main fields, according to the energy program of the Federal Republic, are documented, in addition data to the EC program budget nonnuclear energy are given. In part II the previous work done to construct scenarios is described in detail. Proceeding from a difficult and intricate analysis of available data, scenarios of final energy demand were elaborated, arranged by sectors of consumption and world regions. The construction of scenarios is in detail justified in the text. As an essential feature we should like to emphasize that if -unlike the usual- is based on upper per capita consumptions of sectors of consumption according to regions, population and areas and from these facts determines a demand potential. The Pb capita consumptions result from a comparative analysis of present consumption and its tendencies. Demand potential and present growth tendencies determine the further development of consumption.

12480 (CONF-801030—Vol.3, pp 1091-1096) **Dimensioning the role of alcohol fuels in Brazil's energy future.** Wright, J.T.C. (Universidade de Sao Paulo, Brazil). Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

The Brazilian national alcohol fuel program (PROALCOOL) was initiated in 1975 and, if current expansion goals are met, will produce 10.7 billion litres of ethanol by 1985. An attempt is made at dimensioning PROALCOOL at the end of the century, so as to allow a more accurate assessment on its probable impacts on Brazilian society. Combining projections on the world oil scenario, national economic development, petroleum production and the transportation structure, integrated scenarios are described where ethanol demand ranges from 30 to 60 billion litres in the year 2000, depending heavily on transportation system policies and on oil availability. It becomes clear that long range plans for PROALCOOL must be made considering a broader context of social, economic and technological development issues.

12481 **(EUR—8129-EN) Maintenance of 12C software and adaptation to the data available at DG XVII and national planning offices. Final report.** d'Enghien, E.B. (Systems-Europe S.A., Brussels (Belgium)). 1982. 90p. Commission of the European Communities, 2100 M Street, NW, Washington, DC 20037.

The first sections of the second part describe the main steps of the 12C model adaptation procedure to the study of primary energy needs for the various Member States; next the report presents the results got from the optimization, completed by detailed explanations over the noticed discrepancies between the DG XVII data and the solution obtained by the model. This document presents by way of conclusion a series of remarks pertaining to the results obtained for the various countries with suggestions outlining the additional data to be brought to finish off the model adaptation to the DG XVII data.

12482 **(NP—3901068) Michigan energy futures: requirements to the year 2000.** (Michigan Energy Administration, Lansing (USA)). Mar 1982. 123p. Dept. of Commerce, Law Bldg., 4th Fl., P.O. Box 30004, Lansing, MI.

This joint venture between the Energy Administration of the Michigan Department of Commerce (EA) and the Michigan Energy Resource Research Association (MERA) assesses energy requirements and supplies in Michigan through the end of the 20th century. The project is organizationally divided into two segments: EA described goods and services associated with different levels of energy requirements; MERRA reviewed energy supply projections and prepared a model to integrate energy requirements with supply probabilities. This paper documents the method and data sources which were used to produce forecasts of Michigan's energy requirement levels. A description of the supply and integration model is available in a publication entitled Michigan Energy Futures: Energy Analysis Model (MERRA, 1981).

12483 **(P—700-81-011) Energy resources in California.** (California Energy Resources Conservation and Development Commission, Sacramento (USA). Engineering and Environmental Div.). Nov 1981. 96p. California Energy Commission, 1111 Howe Ave., Sacramento, CA 95825.

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This document provides a concise synopsis and visual representation of California's energy resources, current uses of these resources, and new, innovative ways to use these resources in the future. Chapter One identifies the state's energy resources and their locations; Chapter Two discusses current uses; and Chapter Three describes potential uses of these resources.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 11764, 11774, 11775, 11780, 11786, 11787, 11810, 11811, 11812, 11813, 11819, 12492, 12496, 12510, 12565, 12602, 12603, 12604, 12610, 12616, 13051

12484 **(CONF-8011101—7) Electric utilities and natural gas use.** Berkeley, A.D. (American Public Power Association, Washington, DC). 11 Nov 1980. 8p. American Public Power Assoc., 2600 Virginia Ave., NW, Washington, DC.

From American Public Power Association legal seminar; Boston, MA, USA (10 Nov 1980).

Legal aspects of using natural gas as boiler fuel for electric utilities are reviewed through one utility's challenges to the Power Plant and Industrial Fuel Use implementation. ASARCO vs. FPC, 1973, and City of Willcox vs. FPC are discussed. (PSB)

12485 (CONF-8108141—, pp 2-5) **Synthetic Fuels Corporation progress to date with indications for the future.** Axelrod, L. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

The Synthetic Fuels Corporation will support the private sector in its initial, risk-heavy efforts to construct and operate first-of-a-kind commercial scale synfuels plants, most of which have individual estimated costs running to billions of dollars. The Corporation can provide financial assistance to project sponsors in several forms, including: price guarantees to protect against unexpected declines in world energy prices; purchase agreements for all or part of the plant output; loan guarantees and loans of up to 75 percent of initial project costs; and joint ventures as a limited partner for up to 60 percent of a project module. Incidentally, the Energy Security Act gives higher priority to contingent forms of assistance. The Corporation received 63 proposals in response to its first solicitation of bids, nearly all requesting contingent forms of assistance and reflecting considerable diversity in resource base, technology, and geography. In terms of resource base, 14 are oil shale projects, 16 are coal gasification, 20 are coal or peat liquefaction, and 10 are tar sands and heavy oil projects. We also have a coal-oil mixture project, a solid fuel additive from coal project, and a hydrogen from water project. Proposed projects are located in 24 states, with the heaviest concentration in Colorado, with 10, and Utah, with 9. The proposed technologies are highly varied. For instance, among the 14 oil shale proposals, 11 retorting technologies are represented. Similarly, there are 9 coal gasification technologies proposed to prepare medium Btu gas, high Btu gas, hydrogen, and synthesis gas from bituminous and sub-bituminous coals, lignite, and peat.

12486 (CONF-8108141—, pp 7-13) **Synfuels and electricity from coal: DOE's refocus on R & D.** LeGassie, R.W.A. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Decontrol of conventional fuel prices, revisions of tax policies, the actions of Synthetic Fuels Corporation, and perhaps as significant as any, the creation of a stable government regulatory environment - these will provide the final push to get synfuels across

the commercial threshold. The Department of Energy has oriented its synfuels program toward long-range, high-risk technologies. This presents a unique opportunity to re-examine where public spending is most appropriate. The terms long-range, high-risk are themselves rather vague descriptions. They do not draw a solid line dividing where out program should end and industry's should begin. Financial considerations limit industrial R & D investment to relatively low-risk, short-term projects. One way to increase corporate R & D spending is to ensure that future energy costs reflect true market values and that tax policies are conductive to private sector innovation. The Federal R & D program must be structured to support those promising areas where the private sector is unlikely to invest even with these economic incentives. This means that we must not only define our respective R & D roles today, but recognize that these roles will be continually changing. The problem with natural gas and oil may not be so much availability in the foreseeable future, but price. Regardless of what our graphs say about the actual quantity of the world's remaining hydrocarbons, there can be no uncertainty that they will become increasingly expensive and increasingly difficult to exploit.

12487 **(DOE/ES—0004) United States Department of Energy: a history.** Holl, J.M. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of the Executive Secretary). Nov 1982. 28p. NTIS, PC A03/MF A01. Order Number DE83005326.

This pamphlet traces the origins of the Department of Energy and outlines the history of the Department as reflected in the energy policies of Presidents Nixon, Ford, Carter, and Reagan. It attempts to place recent energy policy into historical perspective by describing the evolution of the federal Government's role in energy research, development, and regulation.

12488 **(GAO/EMD—82-104) Interior's minerals-management programs need consolidation to improve accountability and control.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 27 Jul 1982. 17p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Secretary of the Interior.

The division of responsibilities between the Bureau of Land Management and the Minerals Management Service for managing federal fuel and non-fuel mineral resource programs weakens accountability and control of the programs. Furthermore, minerals management programs are fragmented within the Bureau of Land Management, whose primary goal is surface land management. As major sources of federal receipts and domestic supplies of fuel and non-fuel minerals, these programs require but are lacking clear lines of authority and organization for efficient operations and program review. However, the Minerals Management Service was established specifically to improve management, oversight, and accountability for federal minerals resources and has the potential to provide comprehensive management of these resources. GAO recommends that the Secretary of the Interior consolidate the Department's minerals management programs in the Minerals Management Service.

12489 **(IFUSP-P—296) Energy issues and policies in Brazil.** Goldemberg, J. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Oct 1981. 68p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703379.

Initiative taken in Brazil to achieve 'energy autonomy' in vien of the petroleum crisis is analyzed. The dynamics of the movement away from oil and the desire to base the development of the country on locally available resources such as hydroelectricity and biomass derived fuels are emphasized. Energy resources, energy comsumption, issues and policies, energy projections and social issues are discussed, as well as the relevance and applicability to other countries of policies followed in Brazil.

12490 **Desirable energy future: a national perspective.** Livingston, R.S.; Anderson, T.D.; Besmann, T.M.; Olszewski, M.; Perry, A.M.; West, C.D. Philidelphia, PA; Franklin Institute Press (1982). 262p.

Unlike previous studies, the desirable future described in this book includes continued economic growth at a level similar to that experienced by the US over the last 70 years. It involves the continuation of personal freedom as embodied in the automobile, and means a continuation of established trends in housing. The study asserts that there is no energy crisis, but a set of energy problems of differing importance. The most urgent is the vulnerability of the nation to foreign oil exporters. The study demonstrates that oil imports can be reduced to less than 20% of oil demand by the end of the century. It also concludes that the cost of energy service need not be higher than the price the nation is paying at present. Major changes need to be made in the next two decades on both the demand and supply sides of energy that will require a combination of oil production, conservation, and substitution. The electric-power-generating capacity will need to be increased by a factor of two or three, and coal production will need to increase at a comparable rate even with near-maximum utilization of nuclear power. 151 references, 40 figures, 87 tables.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 11583, 11688, 11689, 11717, 11725, 11738, 11764, 11775, 11780, 11781, 11781, 11783, 11786, 11787, 11788, 11788, 11789, 11790, 11809, 11810, 11811, 11812, 11813, 11818, 11819, 12465, 12484, 12536, 12616, 12640

12491 **(CONF-821220—1) New technologies in fossil-fuel utilization.** Cochran, H.D. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 38p. NTIS, PC A03/MF A01. Order Number DE83004650.

From Seminar on energy policies and programs; Oak Ridge, TN, USA (3 Dec 1982).

This document contains the outline and viewgraphs used in the speech. Topics covered are: conventional oil and gas recovery; unconventional oil and gas sources; oil shale resources; conventional coal combustion; advanced fossil power systems; fluidized bed combustion; coal/oil or coal/water mixtures; and gaseous and liquid fuels from coal. (DMC)

12492 (CONF-8108141—, pp 337-346) **Potential for commercial synthetic fuels in the US energy future.** Corino, E.R. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Our US energy outlook shows the difference between projections of domestic petroleum demand and production to be about 15 million barrels per day of oil equivalent early in the 21st Century. This gap between demand and domestic supply for liquid and gaseous fuels as created the opportunity for development of synthetic fuels. The magnitude of the gap casts a sense of urgency on the opportunity since the only realistic alternative to synthetic fuels is a growing reliance on imported oil-an alternative that is not in the national interest. The rate at which the potential for synthetic fuels is commercialized will be heavily influenced by governmental actions. Because of its concern with security of supply and the effect of oil imports on the nation's balance of payments, Congress created the Synthetic Fuels Corporation with initial funding of $17.2 billion. This legislation, designed to assist the initiation of a commercial synthetic fuels industry, was unquestionably significant, but many other governmental actions are needed to facilitate the development of synthetic fuels on a scale that would appreciably reduce the gap between domestic demand and production of liquid gaseous fuels. The potential of a large-scale synthetic fuels industry cannot be realized if, for example, environmental goals are not balanced with energy objectives, or if the federal leasing program is not modified to encourage rather than limit access to oil shale and coal resources. My point is that unless the government assumes a leadership role, the potential for synthetic fuels will not be developed fully or on a timely basis.

12493 (CONF-8108141—, pp 407-415) **Synthetic fuels: past performance and future plans.** McCleskey, J. (Conoco Coal Development Co., Stamford, CT). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

One difficulty in forecasting future plans for synfuels stems from the unfortunate instability in energy policies which seem to characterize the US scene. There is no way to embark on a synfuel venture without some certainty, at least in the mind of management, that the future supply, demand, costs, prices and government policy are predictable within a reasonable range. The size of these ventures is simply too big to proceed otherwise. There may be bubbles of gas or gluts of oil from time to time, and there can be shortages. We have seen both occur over a time span much shorter than the time required to create a synfuel plant from design to operation. One simply cannot change synthetic fuels plans and programs in tune with these short-term events; there has to be a consistent position. It would seem to me that the basic policy of the US should not be to gamble with the energy supply of this country. It is no great crisis if we have a temporary excess of supply. But it is a crisis, if we are short. We should err, if at all, on the side of abundance. We should recognize that improved tax treatment for synfuels is in the national general interest and not necessarily an additional cost. After all, synthetic fuels can be viewed like the Strategic Petroleum Reserve which has encountered little objection. It is an extraneous added source of fuels which will initially probably cost more than the normal market. But they may, in the end, cost less; or their very existence might keep the market price of imports restrained.

12494 (GFETC/IC—82/1, pp 390-394) **Energy, Texas, and the country.** Hobby, W. 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

Coal and lignite are important to the nation and to Texas. While coal supplied essentially none of the state's energy in 1970 and only 7% in 1980, it is estimated that 21% will be from coal in 1990 and 31% in the year 2000. The principle of increased coal use is sound, but its implementation has not been sound. Application of the Fuel Use Act has imposed impossible capital costs on utilities and rate payers of Texas. Government policy should reflect the fact that a market economy is an efficient vehicle for encouraging production and allocating products. A role exists for the federal government because of the magnitude of the energy problem and because energy costs are both private and public. Expansion of coal production and use of synthetic fuels are not a panacea. They can provide a critical margin of domestically produced energy but are not a substitute for a simplified energy policy.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 12493, 12536

12495 (CONF-8108141—, pp 354-363) **Financing a synthetic fuels plant.** Harris, J.A.; Vogler, W.R. (Koppers Co., Inc., Pittsburgh, PA). Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Today a national consensus exists for serious efforts to improve the position of the United States with respect to inflation and national security. In achieving this goal, the reduction of our dependence on imported crude oil is critical to both our economic and political security. Many of the current optimistic forecasts of future long term price stability for imported crude oil ignore the fact that the current price stability is due not only to the reduced demand of low economic activity but includes many political factors. We seem to have all the elements necessary for moving forward to develop a synthetic fuels industry as a part of reducing our dependence on imported oil: it is critical to reducing the inflation problem; it is paramount to national security; and we have legislation already in place. The Energy Security Act, which established the Synthetic Fuels Corporation, represents a creative approach for government and business to cooperate in achieving a long term strategic goal. The Energy Security Act was drafted to provide a market basket of incentives which could be tailored to satisfy specific projects. The provisions of loan and/or price guarantees will be the result of a negotiation which should assign all risk to equity sponsors in matters over which they have control, but not require them to take risk in areas over which they have no control. Koppers' commitment to this important task of synthetic fuels development includes a commercially proven gasification process and equity participation in three projects. We are convinced it is time to reduce our dependence on OPEC.

12496 (GFETC/IC—82/1, pp 379-389) **Outlook for synthetic fuels.** Larkins, P.R. (Exxon Co., Baytown, TX). 1981. NTIS, PC A99/MF A01.

From 11. biennial lignite symposium; San Antonio, TX, USA (15 Jun 1981).

The 1980's are a decade of choice for Americans between future energy security or future energy dependency. Planning at Exxon is concerned with future levels of energy consumption and what energy sources are available to meet requirements. For insight into long-term trends, the outlook has been extended into the middle of the next century during which there will be an energy transition from primarily a petroleum-dependent economy to an energy-diversified economy. Conservation effects are noted and energy options discussed. Synthetic fuels will be needed in addition to all the conventional oil, gas, and other forms of energy available. Current synthetics technology is reviewed and potential evaluated. Capital needs, social impacts, political considerations, and necessary lead times are considered.

2960 Electric Power

REFER ALSO TO CITATION(S) 11736, 12014, 12286, 12465, 12483, 12526, 12527, 12528, 12529, 12530, 12635, 12636

12497 **(BNL—31364) Simple method for estimating the maximum value of developing new electric power generation technologies.** Lamontagne, J.; Queirolo, A. (Brookhaven National Lab., Upton, NY (USA)). Oct 1982. Contract AC02-76CH00016. 13p. NTIS, PC A02/MF A01. Order Number DE83005121.

The ultimate benefits of expenditures in research and development (R and D) for new technologies depend on the degree of acceptance of these technologies. These benefits (generally computed in terms of net present value) can be used as inputs to the selection process for projects competing for finite R and D funds. In this paper, a simple method of calculating limits to market penetration and maximum net present value for new central-station electric power-generation technoloiges is presented.

12498 **(CONF-8010211—1) Energy diversion: theft of electricity.** Loveless, H.J. Jr. (American Public Power Association, Washington, DC). 1980. 9p. American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC.

From American Public Power Association accounting and finance workshop; San Antonio, TX, USA (7 Oct 1980).

Portions of document are illegible.

The magnitude of electric power theft in the US, its cost to electric utilities (estimated by various sources as between $400 million and $1.7 billion), the prosecution of legal cases against electric power purloiners, and the development by utilities of utility theft prevention programs are discussed. (LCL)

12499 **(CONF-8011101—2) Selected antitrust issues in utility fuels and equipment purchases.** Sanger, H.S. Jr. (American Public Power Association, Washington, DC). 10 Nov 1980. 27p. American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC.

From American Public Power Association legal seminar; Boston, MA, USA (10 Nov 1980).

The effects of cartels on the acquisition of fuels and equipment for US power plants and examples of antitrust suits dealing with this subject are discussed. (LCL)

12500 **(CONF-8011101—3) PURPA - small power production/cogeneration: implementing problems for the utility.** (American Public Power Association, Washington, DC). 1980. 7p. American Public Power Association, 2600 Virginia Ave., N.W., Washington, DC.

From American Public Power Association legal seminar; Boston, MA, USA (10 Nov 1980).

Portions of document are illegible.

Problems related to the implementation of the Public Utility Regulatory Policies Act in circumstances involving small power production and cogeneration are outlined. The topics discussed include: utility obligations; implementation requirements; contract terms; conflicts with other regulations; and justifiable and unjustified noncompliance. (LCL)

12501 **(CONF-8011101—4) Some aspects of utility obligation to serve new retail loads.** Lane, A.T. (American Public Power Association, Washington, DC). 12 Nov 1980. 7p. American Public Power Association, 2600 Virginia Ave., N.W., Washington, DC.

From American Public Power Association legal seminar; Boston, MA, USA (10 Nov 1980).

The legal aspects of the obligation of electrical utilities to supply electric power to new customers, the impact of legislation, such as the Public Utility Regulatory Policies Act, on the obligation, and actions by courts and public service commissions on the control of energy use and on utility services are discussed. (LCL)

12502 **(CONF-8011101—5) Legal remedies for theft of electricity.** Grubbs, S.R. (American Public Power Association, Washington, DC). 12 Nov 1980. 7p. American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC.

From American Public Power Association legal seminar; Boston, MA, USA (10 Nov 1980).

An outline is presented of the criminal and civil remedies available to electric utilities which experience electric power thefts. The problems of identifying the thief, determining how much power is stolen for how long, and the civil liability of the utility are included. (LCL)

12503 **(CONF-8011101—6) Adventures in joint ventures: issues facing attorneys and managers in joint-action power projects.** Allen, D.R. (American Public Power Association, Washington, DC). 11 Nov 1980. 34p. American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC.

From American Public Power Association legal seminar; Boston, MA, USA (10 Nov 1980).

Economic conditions in the 1980's are compelling US electric utilities to become increasingly involved in joint ventures, i.e., the sharing by two or more utilities of the ownership, risk and output of electric power generation and transmission facilities. The economics, tax consequences, legal aspects, and administration features of such joint ventures are discussed. (LCL)

12504 **(DOE/RG/10295—1) Study of aggregation alternatives in the US electric-utility industry.** (Barry (Theodore) and Associates, Washington, DC (USA)). Dec 1982. Contract AC01-80RG10295. 213p. NTIS, PC A10/MF A01. Order Number DE83004443.

Portions of document are illegible. Printed copy available until stock is exhausted.

The Department of Energy's Electricity Policy Project seeks to assess the current state of the electric utility industry, particularly regarding its future ability to continue providing an adequate and reliable electric energy supply at an equitable cost. The primary research objective was to develop a base of knowledge on industry aggregation modes and trends and to investigate, insofar as possible, quantitatively-oriented answers to the question - Is bigger better. The approach used in this study, the perspecitves considered, and the possibilities for aggregating transmission facilities only or both generation and transmission are discussed. This study concludes that the aggregation of electric utilities into fewer and larger entities, along with appropriate regulatory changes, offers the potential for significant benefits, particularly if demand growth increases. These benefits may be achieved, but at substantial costs, and that definite conclusions can be reached on whether particular forms of aggregation should be implemented only by detailed, quantitatively-oriented research in specific regions and/or states. It is recommended that location-specific studies of aggregation be undertaken.

12505 **(EPRI-EA—2639-SR) Generating capacity in US electric utilities: how is it used; how much is needed over the decade.** Keelin, T.W.; Oatman, E.N.; Gent, M.R. (Strategic Decisions Group, Menlo Park, CA (USA); Electric Power Research Inst., Palo Alto, CA (USA); North American Electric Reliability Council, Princeton, NJ (USA)). Oct 1982. 39p. NTIS, PC A03/MF A01. Order Number DE83900733.

This report addresses: how US generating capacity is used to supply today's consumers with electricity; whether new capacity planned over the next decade is enough to provide a secure supply of electricity; how delays and cancellations of planned capacity would result in higher electricity costs and threaten the security of electricity supply; and how today's decisions determine electricity supply for the next decade and beyond. It is concluded that there is not an electricity supply crisis currently, but there is a planning crisis. This conclusion is based on the following: existing capacity supplies current needs, but provides little room for economic growth; new capacity is planned to provide a secure supply of electricity for the demand projected by utilities; if demand is lower, planned capacity will reduce costs and, if demand is higher, planned capacity will not be adequate; planned capacity may not be realized. Delays and cancellations would result in higher electricity costs and threaten the security of electricity supply under utility demand projections; and today's decisions determine electricity supply for the next decade and beyond.

12506 **(GAO/EMD—82-105) Bonneville Power Administration and Rural Electrification Administration actions and activities affecting utility participation in Washington Public Power Supply System Plants 4 and 5.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 30 Jul 1982. 21p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Congressman George Hansen asked GAO to examine the roles of the Bonneville Power Administration and the Rural Electrification Administration in development and termination of Washington Public Power Supply System Plants 4 and 5. The GAO found that BPA provided electric demand forecasting help to small regional utilities, endorsed the need for additional generating units, supported utility participation in the plants, and acted to indirectly facilitate termination of the plants; and that REA directed its borrowers to pay their debts to the Washington Public Power Supply System and implied their financial standing with REA could be affected if their obligations on plants 4 and 5 are not met.

12507 **(MIT/EL—81-031) Methodology and results of the impacts of modeling electric utilities: a comparative evaluation of MEMM and REM.** (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Sep 1981. Contract AM01-76EI02295. 134p. NTIS, PC A07/MF A01. Order Number DE83002753.

Portions of document are illegible.

This study compares two models of the US electric utility industry including the EIA's electric utility submodel in the Mid-term Energy Market Model (MEMM), and the Baughman-Joskow Regionalized Electricity Model (REM). The method of comparison emphasizes reconciliation of differences in data common to both models, and the performance of simulation experiments to evaluate the empirical significance of certain structural differences in the models. The major research goal was to contrast and compare the effects of alternative modeling structures and data assumptions on model results; and, particularly to considered each model's approach to the impacts of generation technology and fuel use choices on electric utilities. The methodology used was to run the REM model first without and, then, with a representation of the Power Plant and Industrial Fuel Act of 1978, assuming medium supply and demand curves and varying fuel prices. The models and data structures of the two models are described. The original 1978 data used in MEMM and REM are analyzed and compared. The computations and effects of different assumptions on fuel use deci-

sions are discussed. The adjusted REM data required for the experiments are presented. Simulation results of the two models are compared. These results represent projections for 1985, 1990, and 1995 of: US power generation by plant type; amounts of each type of fuel used for power generation; average electricity prices; and the effects of additional or fewer nuclear and coal-fired plants. A significant result is that the REM model exhibits about 7 times as much gas and oil consumption in 1995 as the MEMM model. Continuing simulation experiments on MEMM are recommended to determine whether the input data to MEMM are reasonable and properly adjusted. (LCL)

12508 **(ORNL—5918) Options for electricity use and management during a petroleum shortage.** Samuels, G. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 144p. NTIS, PC A07/MF A01. Order Number DE83005156.

This study examines the potential reduction in oil and gas use from deactivating precipitators and flue-gas-desulfurization scrubbers at coal-fired power plants and from switching some residential and commercial space heating from oil to electricity. The benefits that may be derived from these options vary widely between the different regions of the country and depend on the amount of power exchanged between the different regions. Shutting off the scrubbers at those plants equipped with these units could save the equivalent of about 4.5 million bbl/year of oil. Shutting off both scrubbers and precipitators could increase the savings to about 8.9 million bbl/year. The substitution of electrical-resistance heating for heating oil in the residential and commercial sectors may lead to either net savings or losses in the use of premium fuels. The maximum potential net savings range from 25 to 50 million bbl/year of oil, with the benefits restricted to those regions in which almost all generation is from non-oil or -gas capacity. It is also possible that during a petroleum shortage, escalating oil prices would make electrical-resistance heating more economical than oil heating, even in regions dependent on oil and gas for power generation. This could lead to such widespread use of electrical space heating that a net increase in demand for premium fuels would result.

12509 **Plant construction and community stress.** Lihach, N.; Wyzga, R. (Electric Power Research Inst., Palo Alto, CA). *EPRI (Electric Power Research Institute) Journal;* 7: No. 9, 14-17(Nov 1982).

Communities and utilities can project the impact of construction workers, their families, and the services they require before a project begins and take steps to mitigate any negative effects. Systematic socio-economic assessment is only a decade old, but has gradually taken on the importance of environmental impact assessments. An Electric Power Research Institute (EPRI) assessment of 12 case-study plants and their impact on neighboring communities found that population influx was more moderate than expected because of an indigenous work force, the willingness of new workers to drive long distances rather than relocate, and the shift in construction crafts required during the construction phase. Economic impacts were often more positive than expected. The study also underscored the need for proper assessment and appropriate mitigation planning. 2 references. (DCK)

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 12482, 12547

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 11975, 11976, 11978, 11979, 11980, 11983, 12014, 12015, 12019, 12020, 12021, 12024, 12041, 12045, 12046, 12047, 12063, 12066, 12102, 12104, 12111, 12124, 12160, 12173, 12185, 12217, 12218, 12219, 12220, 12221, 12222, 12223, 12224, 12225, 12226, 12227, 12228, 12525, 12526, 12527, 12528, 12529, 12530, 12548, 12634, 12637, 12640

12510 (SERI/CP—234-1590, pp 219-230) **Outlook for methanol in Brazil.** Yang, V. (CTP, Centro de Tecnologia Promon, Rio de Janeiro, Brazil). 1982. NTIS, PC A15/MF A01.

From Biomass-to-methanol specialists workshop; Durango, CO, USA (3 Mar 1982).

The outlook for methanol in Brazil is unique in many ways. A key issue to consider is the role, if any, for methanol as fuel in an ethanol-rich country such as Brazil. This paper addresses this issue by reviewing the background, status and problems confronting PROALCOOL, Brazil's national alcohol program - the world's largest ongoing biomass based synfuel program. It focuses on some of the major effects of a very rapid and successful large-scale penetration of ethanol into the Brazilian gasoline pool. This analysis leads to a discussion of Brazilian alternative energy programs and the potential incentives/barriers for methanol from biomass in the Brazilian context.

12511 **(TENRAC/EDF—001) Texas Energy Development Fund. Volume I. Perspectives for RD & D.** (Texas Energy and Natural Resources Advisory Council, Austin (USA)). 2 Dec 1977. 58p. NTIS, PC A04/MF A01. Order Number DE83900789.

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An overview of the outlook to the year 2000 from conventional sources of energy in Texas, primarily oil and gas, is provided. The prospects from developing energy technologies are described. Legal, technological, economic and institutional problems impeding the development of each of the developing technologies are identified, and the rationale for project solicitation implied from this overview is described.

12512 **(TENRAC/EDF—002) Texas Energy Development Fund. Volume II. Administration plan.** (Texas Energy and Natural Resources Advisory Council, Austin (USA)). Dec 1977. 69p. NTIS, PC A04/MF A01. Order Number DE83900790.

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The following are included: legislative mandate, development of the plan, criteria for funding, solicitation and submission of proposals, evaluation and selection of proposals, project reporting requirements, disbursement of contracted funds and project cost accounting, and dissemination of results. (MHR)

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

12513 **(DOE/ET/10815—75) MHD-Coal-Fired Flow Facility. Quarterly technical progress report, July-September 1981.** (Tennessee Univ., Tullahoma (USA). Space Inst.). Dec 1982. Contract AC02-79ET10815. 71p. (UTSI—82-21). NTIS, PC A04/MF A01. Order Number DE83004815.

Portions of document are illegible. Printed copy available until stock is exhausted.

In this fourth Quarterly report of FY81, The University of Tennessee Space Institute (UTSI) reports on significant activity, task status, planned research, testing, and development for the Magnetohydrodynamics (MHD) Coal-Fired Flow Facility (CFFF) and the Energy-Conversion Facility (ECF). Engineering was completed on a water-cooled burner plate for the vitation heater. Fabrication, installation, and testing will be completed in the next quarter. Fabrication, delivery, and QA inspection of the LMF generator was completed this quarter. Installation of the refractory lining in the radiant boiler and secondary combustor was completed after pressure testing the downstream equipment. The entire flow stream from the vitation heater to the stack went through a series of shakedown tests to verify designs and confirm the interperability of all the components in the system. The LMF CFFF test train with a water-cooled replacement duct substituting for the conductivity channel went through a shakedown test to check interrelationship of each component in the test train. Tests were conducted on 100% oil at half base and 50% coal 50% oil at half base. All cooling circuits operated properly with total heat loss through each circuit slightly less than predicted. Coal flow was irregular with moisture formed lumps plugging filter, coal dispersed and lines. Corrective actions are in process to clear up this area prior to LMF1 testing. Particulate samples, gas chemistry, trace emtal analysis from this shakedown test will be analyzed and the procedure written before LMF1 testing. Experimental work in the coal injector laboraotry

continued on new coal dispersed ideas. The refractory in the vitiation heater, combustor, radiant boiler and the secondary combustor were evaluated after the system shakedown operation. All linings are in good condition indicating proper design and construction.

12514 (DOE/ET/10815—77) MHD Coal-Fired Flow Facility. Quarterly technical progress report, October-December 1981. (Tennessee Univ., Tullahoma (USA). Space Inst.). Dec 1982. Contract AC02-79ET10815. 37p. (UTSI—82/22). NTIS, PC A03/MF A01. Order Number DE83004816.

Portions of document are illegible. Printed copy available until stock is exhausted.

In this first quarterly report of FY82, The Uiversity of Tennessee Space Institute (UTSI) reports on significant activity, task status, planned research, testing and development for Magnetohydrodynamics (MHD) in the Coal-Fired Flow Facility (CFFF) and in the Energy-Conversion Facility (ECF). In Task 2, the preliminary design was completed for the superheater and air heater and the preliminary design report transmitted to DOE. Design work was begun on the alternate flat slag screen for installation in the radiant furnace. The diagnostic channel assembly was completed and installed in the magnet and insturmented for testing in the LMF1 test series scheduled to begin early next quarter. The Materials Test Module (MTM) and the high-pressure system in the radiant furnace, including the lower slag screen and the tube test sections, were installed and prepared for testing next quarter. In Task 3, the primary activities were the installation of the equipment, the instrumentation, and system calibration and checkout for the next test series which has been designated LMF1. In addition, laboratory analyses were performed on samples taken during the LMF0 series. In Task 4, the primary activities were the preparation of the test planning documents for the LMF1 test scheduld to start next quarter, the analysis of data from the LMF0 test series and the preparation of the test report covering this test. This was the first quarter of FY82 in which Task 7 funding was reduced to zero, and funding for the other tasks was severly reduced, making the total budget approximately half the prior FY81 annual budget.

12515 (DOE/ET/15614—2) MHD generator component development. Quarterly report, January-March 1980. (Avco-Everett Research Lab., Inc., Everett, MA (USA)). Jun 1980. Contract AC01-80ET15614. 47p. NTIS, PC A03/MF A01; 1. Order Number DE82006211.

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The overall objectives of this program are twofold: (1) to contribute, by appropriate systematic experimental and analytical investigations, to the engineering data base necessary for the design and construction of MHD generators at CDIF-scale (50 MW/sub th/) and baseload scale (2000 MW/sub th/); and (2) to design and fabricate specific hardware items to be tested at the CDIF site in Butte, Montana. Progress is reported on the following tasks: (1) MHD channel design and performance; (2) MHD channel construction and lifetime; (3) MHD channel loading and control; (4) facility operation (Mk VI and Mk VII test bays); (5) CDIF hardware; and (6) integrated caol-fired flow train testing. (WHK)

12516 (DOE/NASA/10769—28) Methods of reducing energy consumption of the oxidant-supply system for MHD/steam power plants. Juhasz, A.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1983. Contract AI01-77ET10769. 12p. (NASA-TM—83025; CONF-830112—1). NTIS, PC A02/MF A01. Order Number DE83003670.

From 21. aerospace sciences meeting of the American Insitute of Aeronautics and Astronautics; Reno, NV, USA (10 Jan 1983).

An in-depth study was conducted to identify possible improvements to the oxidant supply system for combined cycle MHD power plants which would lead to higher thermal efficiency and reduction in the cost of electricity, COE. Results showed that the oxidant system energy consumption could be minimized when the process was designed to deliver a product O_2 concentration of 70 mole percent. The study also led to the development of a new air separation process, referred to as liquid pumping and internal compression. MHD system performance calculations show that the new process would permit an increase in plant thermal efficiency of 0.6% while allowing more favorable tradeoffs between magnetic energy and oxidant system capacity requirements.

3003 Thermoelectric Generators

12517 (DOE/ET/15420—T1) Cesium-plasma-conductivity enhancement in the advanced thermionic energy converter. Final report. Manikopoulos, C.N. (Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Electrical Engineering). [nd]. Contract AC02-79ET15420. 44p. NTIS, PC A03/MF A01. Order Number DE83004388.

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Two methods of plasma conductivity enhancement in a cesium vapor thermionic energy converter have been studied. The first involved resonance photoabsorption of several cesium lines and the second utilized cesium plasma sustenance by application of microwave power. An extensive study of ionization processes in a cesium discharge in the presence of resonance ionization was made. Calculations were made of expected percentage excitation levels for several cesium resonance transitions for different values of neutral density and temperature as well as incident radiation power levels. The results of some of these computations were tabulated. Several ionization schemes were considered. A number of cesium transitions were investigated in the range of 799 to 870 nanometers for four different cesium reservoir temperatures, 467, 511, 550 and 591 K. The related absorption coefficients of the radiation lines in the plasma were deduced and tabulated. The resulting plasma conductivity increase was recorded and the associated ionization enhancement was deduced. A microwave cavity was built where the emitter and collector of a simple thermionic converter made up two of the cavity walls and resonant microwave power was externally applied. The I-V characteristics of the thermionic converter were studied under several microwave power levels in the range of 0 to 2 watts. Significant shifts to higher currents were observed as the microwave power levels were raised. In conclusion, both methods show promise as auxiliary ionization mechanisms for the thermionic energy converter, especially at low emitter temperatures.

12518 (SAND—82-1885) Quality assurance program for isotopic power systems. Hannigan, R.L.; Harnar, R.R. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 29p. NTIS, PC A03/MF A01. Order Number DE83005250.

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This report summarizes the Sandia National Laboratories Quality Assurance Program that applies to non-weapon (reimbursable) Radioisotopic Thermoelectric Generators. The program has been implemented over the past 16 years on power supplies used in various space and terrestrial systems. The quality assurance (QA) activity of the program is in support of the Department of Energy, Office of Space Nuclear Projects. Basic elements of the program are described in the report and examples of program documentation are presented.

3004 Thermionic Converters

12519 (TE—4258-442-82) Preliminary investigations of thermionic converters utilizing HOTEMA and DFVLR electrodes. Saunders, M.; Danielson, L.; Huffman, F. (Thermo Electron Corp., Waltham, MA (USA)). Nov 1982. Contract AC02-76ET11292. 45p. NTIS, PC A03/MF A01. Order Number DE83004107.

Experiment results obtained from three thermionic converters using improved electrodes are reported. Two converters with ZrO_2-Mo cermet electrodes produced by a low pressure plasma spray technique at the DFVLR in Stuttgart were fabricated and tested. The first of this pair of diodes was outgassed and operated at high temperatures and did not show improved thermionic performance. The second of the two was outgassed and operated at more moderate temperatures. An encouraging barrier index of 2.00 eV at T/sub E/ = 1400°K was recorded. Additionally, pre- and postoperational diagnostics confirmed that elemental concentrations on the emitter were nearly equal before and after operation. How-

ever, these electrodes did not give stable performance at emitter temperatures corresponding to practical ouput power densities. The Mo-Al_2O_3, Cr_2O_3 eutectic emitter developed by HOTEMA in the Netherlands exhibited stable performance at emitter temperatures up to 1650°K. The barrier index at T/sub E/ = 1400°K was 2.04 eV. The minimum collector work function as measured by the retarding plot method was 1.53 eV. This low work function may be related to the presence of oxygen (which was verified by postoperational diagnostics) on both the emitter and collector. These results suggest that an emitter of this type has the potential of providing significantly improved thermionic converter performance, and should be investigated further.

3005 Fuel Cells

12520 **(BNL—32172) Advanced chemistry and materials for fuel cells.** O'Grady, W.E.; McBreen, J. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 4p. (CONF-821211—4). NTIS, PC A02/MF A01. Order Number DE83003960.

From 5. DOE battery and electrochemical contractor's conference; Crystal City, VA, USA (7 Dec 1982).

The development of new fuel-cell capabilities requires advances in electrocatalysis, electrolytes and electrode structures. In this research program, we are concentrating on developing an understanding of the electrocatalysis of the oxygen reduction reaction and the direct oxidation of several organic fuels including formic acid, carbon monoxide and methanol. In order to achieve this goal, we are undertaking to relate the kinetics and mechanism of the reaction to the electronic and geometric structure of the catalyst surface. Furthermore, the kinetics and mechanisms of these reactions are being studied in the fluosulfonic acid electrolytes. Progress is reviewed. (WHK)

12521 **(DOE/ET/12231—T1) Concentration cells for combustion improvement. Final report on reaction rate in a zirconium-yttria solid-electrolyte fuel cell.** Gaggioli, R.; Walker, D.W. (Marquette Univ., Milwaukee, WI (USA)). Nov 1982. Contract FG01-78ET12231. 100p. NTIS, PC A05/MF A01. Order Number DE83002773.

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This report deals with the reaction rate for fuel oxidation in a solid-electrolyte fuel cell of zirconium doped with yttria. An experimental apparatus was developed for measuring cell current and voltage across a load at several fuel and air flow rates at temperatures in the neighborhood of 950°C. The resultant data was used to deduce two correlations between the reaqtion rate and chemical affinity. It was found that the reaction rate was essentially independent of the flow rates, over the flow ranges covered by the reliable experimental runs. The correlations are given (1) by R/S = e [A/RT] where A is the chemical affinity and e = 7.58 x 10^{-12} lb mole/(sec in^2). And (2) by R/S = a[exp(bA/RT)-1] where a = 5.39 x 10^{-10} lb mole/(sec in^2) and b = 1.205 x 10^{-2}. Another important conclusion following from the experimental results is that, under normal operating conditions, the available energy consumption associated with fuel-oxidation kinetics cannot be neglected. For example, close to maximum power, the oxidation consumption is 200 times the electrolyte resistance consumption. These results are not only valuable in themselves, but are utilized in a computer model for simulating the performance of arrays of solid-electrolyte fuel cells, as well as the utilization of such arrays for improivng the performance of conventional power plants.

12522 **(DOE/NASA—0241-5) Develop and test fuel-cell-powered on-site integrated total-energy systems: Phase III, full-scale power plant development. 5th quarterly report, February-April, 1982.** Kaufman, A.; Johnson, G.K. (Engelhard Corp., Edison, NJ (USA). Engelhard Industries Div.). 3 Nov 1982. Contract AI01-80ET17088. 45p. (NASA-CR—168020). NTIS, PC A03/MF A01. Order Number DE83005613.

Satisfactory performance is reported for the first 12-cell substack of the 5 kW rebuild using improved ABA reactant distribution plates. Construction and test results are described for the first full-sized single-cell test (0.33 m x 0.56 m). Test duration was 450 hours. Plans are outlined for construction and testing of two methanol reformer units based on commercially-available shell-and-tube heat exchangers. A 5 kW-equivalent precursor and a 50 kW-equivalent prototype will be built. Supporting design and single-tube experimental data are presented. Stack support efforts are summarized on corrosion currents of graphite materials and acid-management of single-cell test facilities. Comparative properties are summarized for the two methanol/steam reforming catalysts evaluated under Tak V (now completed): T2107RS and C70-2RS.

12523 **(PB—83-102335) On-site fuel cell power plant technology development program. Annual report Jan 81-Dec 81.** Mientek, A.P. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Jul 1982. 138p. NTIS, PC A07/MF A01.

Fuel cell power plant designs, specifications and technologies were evaluated to define a power plant approach having the potential for meeting initial on-site commercial service market requirements and costs. An initial commercial market segment was defined for a range of power plant sizes. A preliminary power plant specification and model power plant system were selected as a baseline for further technology development and cost reduction efforts in subsequent program phases. Inverter designs with advanced individual commutation circuitry were defined and evaluated. Sulphur-tolerant reformer catalysts were tested and cell performance on sulphur-bearing fuels was determined. Electrode substrates having greater electrolyte storage capacity and intercell cooler concepts having improved corrosion resistance were developed. Life characteristics of water cleanup demineralizer resins were determined as a function of operating temperature. Commercial equipment availability was established for a number of heat exchangers, electromechanical components and controls for the power plant configurations being considered for on-site applications. Two 24-cell stacks operating at 40-kW power plant conditions reached 11,765 hours and 24,000 hours.

12524 **(PB—83-102343) Carbonate fuel cell system development for industrial cogeneration. Final report Mar 80-Aug 81.** Schnacke, A.W.; Reinstrom, R.M.; Najewicz, D.J.; Dawes, M.H. (General Electric Co., Schenectady, NY (USA). Advanced Energy Programs Dept.). Sep 1981. 153p. NTIS, PC A08/MF A01.

A survey of various industries was performed to investigate the feasibility of using natural gas-fueled carbonate fuel cell power plants as a cogeneration heat and power source. Two applications were selected: chlorine/caustic soda and aluminum. Three fuel processor technologies, conventional steam reforming, autothermal reforming and an advanced steam reformer concept were used to define three thermodynamic cycle concepts for each of the two applications. Performance and economic studies were conducted for the resulting systems. The advanced steam reformer was found among those studied to be most attractive and was evaluated further and compared to internally reforming the fuel within the fuel cell anodes. From the results of the studies it was concluded that the issues most affecting gas-fired carbonate fuel cell power plant commercial introduction are fuel cell and stack development, fuel reformer technology and the development of reliable, cost-effective heat transfer equipment.

12525 **(SAN—1492-1) Fuel-cell power-system configurations utilizing waste-derived fuels. Summary of final technical report for the period September 1977-August 1978.** (Science Applications, Inc., La Jolla, CA (USA)). 1978. Contract AC03-76SF90438. 61p. (SAI—78-856-LJ). NTIS, PC A04/MF A01. Order Number DE83005522.

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The objectives of this study are to recommend a technology development and demonstration program, achievable in the mid-1980's, for one or more fuel cell power system configurations which utilize fuels derived from wastes, and which when commercialized result in significant energy savings at the national level. To meet the objectives of the study, data on the sources, composition and quantities of wastes in the United States was compiled and energy potential determined. Various process alternatives of fuel-cell power systems utilizing waste derived fuels were developed.

Various waste-gasification (liquid and gases) systems and fuel-cell systems were identified and an evaluation criteria developed. Initial screening of the systems was performed by applying these criteria to the identified systems. Conceptual designs were performed for the selected systems to determine the overall efficiencies, environmental impacts, and the electricity-production cost. The conceptual design led to the identification of technology gaps, process uncertainties, and the associated technical risks. Again applying the developed evaluation criteria to the designed systems, final selection of systems for demonstration was made. The size of the facilities for conceptual design was determined from economic viability and practicality points of view. However, the size of demonstration units was determined from the technical and economic scale-up points of view. The technological problems expected to be encountered are clearly defined. Technology development and demonstration program is developed, schedules made and funding requirements are estimated.

12526 **(UCID—19412-Vol.1) Fuel-cell technology assessment. Volume I. The potential value of US fuel-cell technology in foreign countries.** Latorre, V.R.; Spogen, L.R. Jr. (Lawrence Livermore National Lab., CA (USA)). 15 Aug 1982. Contract W-7405-ENG-48. 60p. NTIS, PC A04/MF A01. Order Number DE83004372.

Fuel-cell power plants are in an advanced state of development. Many factors influence whether these plants will be used in a specific country and whether US industry will supply them. The potential for US fuel cell technology in selected countries (Japan, Tunisia, Taiwan, and South Korea) has been evaluated. This report provides the results of the evaluations and the pertinent factors which influenced their outcome. The report is in five volumes. Volume I outlines the approach; presents basic data on fuel cells and their competitors for several applications; describes evaluation procedures; specifies country data needed for the evaluations; and presents the step-by-step method used. Each of the remaining volumes present country data for the subject country and provide the evaluation of that country using the procedure defined in Volume I. (WHK)

12527 **(UCID—19412-Vol.2) Fuel-cell technology assessment. Volume II. Evaluation of Japan.** Latorre, V.R.; Spogen, L.R. Jr. (Lawrence Livermore National Lab., CA (USA)). 15 Aug 1982. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01. Order Number DE83004146.

Fuel cell power plants are in an advanced state of development. Many factors influence whether these plants will be used in a specific country and whether US industry will supply them. The potential for US fuel cell technology in selected countries has been evaluated. This report provides the results of the evaluations and the pertinent factors which influenced their outcome. The report is in five volumes. Volume I outlines the approach; presents basic data on fuel cells and their competitors for several applications; describes evaluation procedures; specifies country data needed for the evaluations; and presents the step-by-step method used. This volume presents data for Japan and provides the evaluation of that country using the procedure defined in Volume I. (WHK)

12528 **(UCID—19412-Vol.3) Fuel-cell technology assessment. Volume III. Evaluation of Tunisia.** Latorre, V.R.; Spogen, L.R. Jr. (Lawrence Livermore National Lab., CA (USA)). 15 Aug 1982. Contract W-7405-ENG-48. 27p. NTIS, PC A03/MF A01. Order Number DE83004294.

Fuel-cell power plants are in an advanced state of development. Many factors influence whether these plants will be used in a specific country and whether US industry will supply them. The potential for US fuel cell technology in selected countries has been evaluated. This report provides the results of the evaluations and the pertinent factors which influenced their outcome. The report is in five volumes. Volume I outlines the approach; presents basic data on fuel cells and their competitors for several applications; describes evaluation procedures; specifies country data needed for the evaluations; and presents the step-by-step method used. This volume presents data for Tunisia and provides the evaluation of that country using the procedure defined in Volume I. (WHK)

12529 **(UCID—19412-Vol.4) Fuel-cell technology assessment. Volume IV. Evaluation of Taiwan.** Latorre, V.R.; Spogen, L.R. Jr. (Lawrence Livermore National Lab., CA (USA)). 15 Aug 1982. Contract W-7405-ENG-48. 27p. NTIS, PC A03/MF A01. Order Number DE83004160.

Fuel-cell power plants are in an advanced state of development. Many factors influence whether these plants will be used in a specific country and whether US industry will supply them. The potential for US fuel-cell technology in selected countries has been evaluated. This report provides the results of the evaluations and the pertinent factors which influence their outcome. The report is in five volumes. Volume I outlines the approach; presents basic data on fuel cells and their competitors for several applications; describes evaluation procedures; specifies country data needed for the evaluations; and presents the step-by-step method used. This volume presents data for Taiwan and provides the evaluation of that country using the procedure defined in Volume I. (WHK)

12530 **(UCID—19412-Vol.5) Fuel-cell technology assessment. Volume V. Evaluation of South Korea.** Latorre, V.R.; Spogen, L.R. Jr. (Lawrence Livermore National Lab., CA (USA)). 15 Aug 1982. Contract W-7405-ENG-48. 24p. NTIS, PC A02/MF A01. Order Number DE83004299.

Fuel cell power plants are in an advanced state of development. Many factors influence whether these plants will be used in a specific country and whether US industry will supply them. The potential for US fuel cell technology in selected countries has been evaluated. This report provides the results of the evaluations and the pertinent factors which influenced their outcome. The report is in five volumes. Volume I outlines the approach; presents basic data on fuel cells and their competitors for several applications; describes evaluation procedures; specifies country data needed for the evaluations; and presents the step-by-step method used. This volume presents data for South Korea and provides the evaluation of that country using the procedure defined in Volume I. (WHK)

12531 **Fuel cells: technology status and applications. Symposium proceedings.** Chicago, IL; Institute of Gas Technology (1982). 340p. (CONF-811148—). Institute of Gas Technology, 3424 South State St., Chicago, IL $40.00.

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

Separate abstracts were prepared for 15 of the 18 papers presented. Three papers were previously included in the data base. (WHK)

12532 **Fuel cells: fundamentals and types - unique features.** Selman, J.R. (Illinois Inst. of Tech., Chicago). pp 1-31 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

The characteristics of fuel cells are discussed from the viewpoint of chemical engineering. Fuel cells are heterogeneous catalytic reactors with several special features: (1) charge and reactant separation by an ionic/electronic conduction circuit; (2) two- or three-phase reaction zones (electrodes); (3) significant heat effects; and (4) intrinsic corrosion tendencies. The thermodynamics of electrochemical reactors yield simple relationships for heat effects and theoretical energy conversion efficiency. Actual performance is limited by three types of irreversibility: (1) of the electrode reaction (kinetic overpotential); (2) of mass transfer to the electrode (concentration overpotential); and (3) of current conduction (ohmic resistance). All three play a role in the design of an effective gas-diffusion electrode. The main types of fuel cells and fuel cell electrodes are reviewed from this point of view. Porous-electrode models may help to understand and quantitatively analyze the rate processes taking place in fuel cells. In scaled-up cells and cell stacks the overall performance depends strongly on the uniformity or nonuniformity of reaction rate and temperature.

12533 **Fuel cell systems and potential applications.** Maru, H.C. (Energy Research Corp., Danbury, CT). pp 33-44 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

A general fuel cell system consists of several subsystems, including fuel cell, fuel processor, power conditioner and thermal management. The options and configurations possible for each of these subsystems are discussed in this paper. Selection of the appropriate subsystem is largely governed by the end application. A broad spectrum of fuel cell applications is visualized, from space systems to multimegawatt central generators. Important requirements of these applications are discussed.

12534 **Molten carbonate fuel cells: technology status.** Pierce, R.D. (Argonne National Lab., IL). pp 67-81 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

The Department of Energy, the Electric Power Research Institute, the Gas Research Institute, individual utilities, and private companies are sponsoring research on molten carbonate fuel cells, which are attractive for central station electricity generating plants and industrial cogeneration plants. The demonstrated performance of single cells is promising, and the current program emphasis is on developing stacks of cells leading to the scaleup of components and manufacturing techniques. United Technologies and General Electric are the major contractors working on power plant systems analysis and stack development. The status of the technology for individual cell and stack components and areas of current research are discussed.

12535 **Defense applications of fuel cells.** Barthelemy, R.R. (Aero Propulsion Lab., Wright-Patterson AFB, OH). pp 109-115 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

The Department of Defense maintains an active interest in the application of fuel cell technology. The Army, Air Force, and Navy have been involved for over 15 years in fuel cell technology development for such varied applications as mobile power generators, transportation vehicles, airfield lighting, communication and transmitter devices, satellite power systems, prime power remote site generators, submerged vehicles, buoy transmitters, and other applications. The Army maintains extensive research and development efforts in small, mobile power systems for tactical missions. These programs have culminated in the recent development of 1.5 kW phosphoric acid fuel cells and 30W solid polymer electrolyte (SPE) fuel cells. The Air Force's involvement in fuel cells is based on previous efforts for space systems. The Air Force's Aero Propulsion Laboratory is now pursuing the use of large phosphoric acid fuel cell power systems in remote site and mobile systems and the use of small SPE fuel cells in mobile communications systems. Also, the Air Force, as the DOD focal point for fuel cell technology, is working actively with the Department of Energy 40 kW Fuel Cell Operational Feasibility program to use these fuel cells at five military installations. The DOD's involvement in fuel cell technology is directed to satisfy departmental objectives of: (1) increased force readiness and decreased use of petroleum; (2) reduced vulnerability to energy supply disruption; and (3) minimized energy costs due to increasingly expensive fuels and increased energy efficiency in military operations.

12536 **Outlook for fuel supplies for fuel cells.** Foster, R.B. (Inst. of Gas Tech., Chicago, IL). pp 117-129 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

Choosing the optimum fuel supply for a commercial fuel cell is a complex problem. The physical characteistics of the fuel actually fed into the cell are generally much more stringent than the physical properties of commercially available fuels. This requires that a substantial amount of equipment be installed ahead of the fuel cell to convert or reform the raw fuel supply to make it more compatible with the fuel cell. This equipment is not only an expensive and complex addition to the fuel cell system, but it also tends to restrict the flexibility of selecting other commercial fuel supplies once the system has been built and put in operation. For this reason the determination of the form and source of fuel supply becomes an important consideration in the design and development phase of the fuel cell system. This paper does not address the intricate problems, both technical and economic, of modifying commercially available fuels to suit the requirements of various fuel cells. It addresses only the fuel supply, price, and logistics problems of commercially available fuels to enable the fuel cell designer to select a form of fuel that will continue to be available at acceptable costs throughout the economic life of his fuel cell system.

12537 **Electricity generation from coal using fuel cells: preliminary systems analysis.** Fleming, D.K. (Inst. of Gas Tech., Chicago, IL). pp 131-152 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

A preliminary systems analysis has been undertaken for the integration of fuel cells with coal gasifiers to produce electricity directly from coal. In the total system, carbon is electrochemically oxidized to carbon dioxide with internal recycles of water and carbon dioxide, with supplemental combustion of carbon with oxygen to provide the heat demand of individual system elements. The system was examined for efficiency only. Because this was a conceptual, overview approach, capital requirement could not be considered. Several concepts were developed, pointing to improved system efficiency relative to systems that are currently under consideration. In particular, incorporation of internal reforming within the fuel cell, in conjunction with a gasifier configuration that produces significant methane, appears attractive.

12538 **Processing of liquid hydrocarbons for fuel cell applications.** Young, J.E. (Argonne National Lab., IL). pp 153-161 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

In this paper the status of the technology related to the conversion of liquid fuels to fuel cell feeds is described. The constraints placed on any fuel conversion process by the fuel cell operating requirements are discussed in detail. Fuel conversion processes presently available for fuel cell application are described as well as processes currently in the technology development stage. Requirements for additional research and development in the area of liquid fuel utilization are discussed.

12539 **Fuel cells for electric utility applications.** Gillis, E.A. (Electric Power Research Inst., Palo Alto, CA). pp 163-172 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

Fuel cell power plants are an emerging option for electric utility power generation because of their efficiency, modularity, environmental acceptability, and fuel flexibility. Because of these features, fuel cells are envisioned for two types of applications in utility systems, namely as small load-following power plants located in populated areas, and in the longer term as large coal-fueled central station plants. This paper summarizes the cost and performance goals that fuel cell systems must achieve to be used by utilities in these applications. The EPRI program to help develop phosphoric acid and molten carbonate fuel cells for these applications is also described.

12540 4.8 MW fuel cell demonstratrator: a step toward commercialization. Bell, R.A.; Hayman, R.B. (Consolidated Edison Co. of New York, Inc., NY). pp 173-187 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

Fuel cell power plant characteristics such as high fuel efficiency, modular design, and environmentally clean emissions could be beneficial to electric utilities. Recognizing these benefits several utilities, including Con Edison, joined with United Technologies Corporation in 1971 to explore the potential of fuel cell technology for commercial electric power generation. These early efforts eventually led to the construction of the 4.8 MW Fuel Cell Demonstrator in New York City. Site construction for the Fuel Cell Demonstrator began in November 1978 and by the end of 1980 most plant components were installed and site construction was essentially completed. A significant schedular delay was caused by damage to heat exchangers due to freezing weather and water remaining from shop hydrostatic tests. After testing the fuel processing equipment, the fuel cell stacks will be installed during early 1982 and operational testing will begin. Several interim conclusions have been made and experience with the 4.8 MW Demonstrator has been factored into the design of an 11 MW commercial version of a fuel cell power plant. Completion of the 4.8 MW Fuel Cell Demonstrator tests as presently planned would occur during 1983. Additional testing, however, is being considered to demonstrate ability to utilize coal-derived liquid fuels, to recover and use reject heat energy, and to test longer-life fuel cells. It is concluded that the phosphoric-acid fuel cell is within sight of becoming a commercial reality for electric utility use during this decade.

12541 40-kW phosphoric acid fuel cell field test: project plan. Woods, R.R. (Gas Research Inst., Chicago, IL); Duscha, R.A. pp 215-231 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

The Field Test Project is directed at generating the performance, reliability, and market data sufficient to make commitments toward onsite fuel cell energy service in the mid-1980s. This overall Project is a coordinated and cooperatively funded program between the US Department of Energy (DOE), the Gas Research Institute (GRI), a group of participating gas and power utilities, the manufacturer (United Technologies Corporation [UTC], the National Aeronautics and Space Administration (NASA), and GRI-supporting contractors (Science Applications, Inc. [SAI], Insights West [IW], and UTC). The overall Field Test Project has two major activities: (1) field testing activities (manufacturing and testing of forty-eight power plants); and (2) business assessment activities. Field testing activities will verify operational feasibility of 40-kW power plants in a variety of attractive early entry markets. Business assessments by the potential user utilities will examine and define the potential business scenarios for commerical onsite fuel cell energy service to be offered and assess their meaning to each utility. For this concept of energy service to gain acceptance by the consumers, utilities, and manufacturers, the Field Test Project must accomplish the following: (1) establish performance and operational reliability; (2) verify fuel conservation and environmental characteristics; (3) evaluate institutional, regulatory, code, and legal issues; and (4) assess system economic performance and market potential.

12542 Role of fuel cells in industrial cogeneration. O'Sullivan, J.B. (Inst. of Gas Tech., Chicago, IL). pp 243-299 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

The presentation reviews the history and status of cogeneration and where it is going. Most of the studies relating to the use of fuel cells in cogeneration are summarized, and some of the trends in those studies and in the systems designed for those applications are indicated. These trends result from an increase in the maturity of thought and fuel cell development as applied to cogeneration systems. There is some peripheral work relating to competing technologies and some on the influence of fuels used that are indicated. Finally, some general conclusions relative to cogeneration and factors that must be considered in any implementation are presented. (WHK)

12543 Fuel cell cogeneration in the wastewater treatment industry. Barbolini, R.R. (Metropolitan Sanitary District of Greater Chicago, IL). pp 301-306 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

Increasing energy costs have provided an urgent incentive for all sectors of the economy to contain their operating costs by reducing their consumption of energy. The wastewater treatment industry has been no exception to this rule. Due to the nature of most wastewater treatment processes, significant quantities of energy-bearing waste gas are produced. This waste gas can be efficiently used in fuel cells that generate electricity and heat which can be beneficially consumed within the wastewater treatment plant, thus reducing the plant's need for outside purchased energy. Finally, since there are approximately 19,000 publically owned wastewater treatment plants in the United States, there appears to be a promising market for fuel cell systems.

12544 Carbonate fuel cell power plant systems. Reinstrom, R.M. (General Electric Co., Schenectady, NY). pp 307-329 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

Carbonate fuel cells are an attractive means of developing highly efficient power plants capable of achieving low atmospheric emissions. Because carbonate fuel cells can be used with coal-derived fuel gases and their operating temperatures allow the use of turbomachinery bottoming cycles, they are well suited for large installations like central utility stations. Presently, system development activity is directed toward evaluating the readiness of gasifier and fuel processor technology, defining candidate cycle configurations, and calculating projected plant efficiencies.*

12545 Engelhard fuel cell programs. Smith, G.A. (Engelhard Industries, Iselin, NJ). pp 331-335 of Fuel cells: technology status and applications. Symposium proceedings. Chicago, IL; Institute of Gas Technology (1982).

From Conference on IGT fuel cells technology status and applications; Chicago, IL, USA (16 Nov 1981).

The development of a family of fuel cell systems in the 5 watt to 500 watt range is briefly described. Applications mentioned include landing lights for use by Army helicopters, portable TV's, fork lift trucks, and on-site integrated energy systems. (WHK)

3008 Miscellaneous Converters

12546 (EPRI-ER—1262) Thermophotovoltaic conversion from conventional heat sources. Final report. Levy, S.L.; Galluzzo, N.G. (Black and Veatch Consulting Engineers, Kansas City, MO (USA)). Dec 1979. 111p. NTIS, PC A06/MF A01. Order Number DE83901087.

Portions of document are illegible.

The feasibility of electric generation from conventional heat sources by means of thermophotovoltaic (TPV) systems is assessed. The assessment was initiated to explore the opportunities for use of high-efficiency silicon TPV cells in alternative power-conversion systems. TPV conversion with conventional heat sources is unattractive under current conditions; the reasons are presented and the circumstances under which this situation would change are given. The studies show that a TPV system would be interior to competing systems, based on the inability to use it as a topping cycle, the inability to efficiently use a TPV system without recourse to expensive recuperators, the necessity to use expensive clean fuels, the high losses in a TPV stand-alone system, and the inability to adapt a TPV system to use nuclear fuel. R & D efforts are outlined which could improve the economic and functional attractiveness of

TPV systems. It also identifies areas which influence the competitive position of TPV conversion to permit reappraisal if key R & D breakthroughs occur in the future. However, it is recommended that at this time EPRI not pursue R & D devoted to TPV conversion from conventional heat sources. The above conclusions do not apply to a solar TPV system because combustion gases do not flow through it. In a solar TPV system, the refractory radiator required can operate in an inert environment; furthermore, there is no need to recover the energy in the flow-through gases. Solar/fossil hybrid systems were also considered but are precluded by the constraints imposed to control parasitic losses.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 11998, 12001

12547 (CONF-811175—, pp 44-52) **Energy conservation in Mexico.** Bazan, G. Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

Mexico's national energy balance is given and possibilities of energy saving are discussed. Energy conservation programs in Mexico are then described, including specifically energy conservation in buildings. (LEW)

12548 **(DOE/CS/21348—T1) Financing conservation and renewable energy in the eighties.** Hansen, D.; Bolle, T. (Hansen (Derek) and Associates, Inc., San Francisco, CA (USA)). 24 Jul 1982. Contract AC01-80CS21348. 97p. NTIS, PC A05/MF A01. Order Number DE83002162.

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The purpose of the reported research was to determine if any financial barriers are likely to inhibit economically sound conservation and renewable energy development, and, if so, what measures can be taken to eliminate them. The major focus is on the inefficiencies in the financial marketplace affecting energy conservation and development. Basic financing issues are outlined that will affect policy judgments. These include government and private responsibility for energy finance and cost subsidy vs capital access assistance. A number of policy recommendations are then made. Special papers are appended on the impact of oil price on energy development, characteristics of new small businesses, and financial institution risk and regulation. (LEW)

12549 **(PB—82-257494) A description and evaluation of the Jackson County Action to Save Energy Program. Final report.** Richey, W.M.; Lanier, W. (Shawnee Solar Project, Carbondale, IL (USA)). Jul 1981. 172p. NTIS, PC A08/MF A01.

The Jackson County Action to Save Energy Program, funded through a federal energy grant, was designed to provide information on low-cost energy conservation techniques to Southern Illinois residential energy users and to provide conservation materials to low-income participants. This evaluation of the program goes beyond the usual statistical analysis of whether program goals and objectives have been met. Its descriptions of program elements and problems encountered, along with suggestions from those who carried out the program or received its services, would be highly useful to groups or agencies setting out to establish similar programs; it could help in avoiding mistakes and in achieving greater efficiency.

12550 **(TENRAC/EDF—048) Program planning document for energy-conservation research, development, and demonstration in Texas. Final report.** Green, T.F. (Radian Corp., Austin, TX (USA)). 31 Aug 1981. 437p. NTIS, PC A19/MF A01. Order Number DE83900877.

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The execution of five efforts and the results obtained from these efforts to develop energy conservation technologies are described. The efforts are: to define conservation technologies pertinent to Texas, review the technologies, propose candidate projects to address needed development, establish criteria for prioritizing the candidate projects, and identify priority projects for developing energy conservation technologies by applying the established criteria. The project methodology and rationale are described, including the conduct of each individual effort. An assessment of each of the program areas addressed is provided. The candidate project scores are then summarized and the projects and program areas of first order priority are presented. The candidate projects and their individual characterizations are appended. (LEW)

3201 Buildings

REFER ALSO TO CITATION(S) 12134, 12140, 12152, 12154, 12175, 12508, 12640, 12891, 12892

12551 **(AD-A—118898/6) Controlling energy consumption in single buildings. Final report for period ending May 82.** Rees, J. (Newcomb and Boyd Consulting Engineers, Atlanta, GA (USA)). Jul 1982. 111p. NTIS, PC A06/MF A01.

Guidelines are given for using microprocessor-based equipment to control energy in buildings. Energy conservation control strategies are discussed and simplified energy savings calculations explained. The results of a survey of currently available equipment suitable for use as energy controllers is included as well as selection guidance for which class of equipment will provide the needed features.

12552 **(AD-A—119102/2) A methodology for determining building heating system changeover timing. Master's thesis.** Formwalt, W.A. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Aug 1982. 107p. NTIS, PC A06/MF A01.

This thesis develops a straightforward and accurate method to determine mechanical heating system changeover timing. Transitional season weather causes buildings to stay within acceptable thermal comfort ranges without requiring supplemental heating. Significant energy savings can be realized if heating plants can be shut down during periods they are not required. The term 'trigger temperature' is used to describe the minimum acceptable comfort conditions which must be maintained before changeover can be made. Computer simulation of ninety-four hypothetical office buildings is used to record data for hourly building temperatures. Statistical regression analysis techniques are employed to analyze the data and develop temperature prediction models for a range of building envelopes and occupancy schedules. Hand calculation and micro-computer applications are offered to provide changeover decision criteria for facility managers using this method.

12553 (CONF-811175—, pp 53-72) **Climate, energy demands and energy consumption with special regard to human settlements.** Taesler, R. (Swedish Meteorological and Hydrological Inst., Norrkoeping, Sweden). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

Energy demands and conservation in relation to climate in the housing sector is discussed after some brief comments on energy demands in other sectors (industry, transportation, and agriculture). Topics covered include energy conservation in building design and the required climatological data. Applications of climatology for energy conservation in regional and urban planning is discussed, illustrated by examples. (LEW)

12554 (CONF-811175—, pp 155) **Using weather forecasts for a more efficient use of heating systems.** Lamboley, G. (Agence pour les Economies d'Energie, Paris, France). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12555 (CONF-811175—, pp 156) **Effects of atmospheric variability on energy utilization and conservation.** Reiter, E.R. (Colorado State Univ., Fort Collins). Sep 1981. NTIS (US Sales Only), PC A08/MF A01.

From WMO technical conference on meteorology and energy; Mexico City, Mexico (3 Nov 1981).

12556 **(CONF-820112—11) Short-tube refrigerant-flow restrictors.** Mei, V.C. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01. Order Number DE82017546.

From Semiannual meeting of the American Society of Heating, Refrigerating, and Air Conditioning Engineers; Houston, TX, USA (24 Jan 1982).

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Five short-tube refrigerant expansion devices, with L/D ratios from 7.5 to 11.9, were tested on a 3-ton split-system heat pump. The test results show that first stage choking has occurred at the liquid subcooling temperature of 22.2 C° (40.0 F°). However, there is no indication that second stage choking has ever occurred. Based on the test results, two correlations were formed. One is an orifice model with the orifice constant as a function of the pressure differential and the level of liquid subcooling. This model is for liquid subcooling less than 22.2 C° (40.0 F°). The other is a first stage choking model, which is for a level of liquid subcooling above 22.2 C° (40.0 F°).

12557 **(CONF-821213—3) Applicability of earth coupled heat pumps and factors affecting their performance.** Intemann, P.R.; Fairchild, P.D. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 14p. NTIS, PC A02/MF A01. Order Number DE83004616.

From 5. international conference on alternative energy source; Miami Beach, FL, USA (13 Dec 1982).

Earty-coupled heat pumps are closed-loop systems placed underground to take advantage of favorable thermal characteristics of the subsurface. Design concepts have been divided into three categories: shallow horizontal coils, multiple shallow wells, and single deep wells. In some areas earth-coupled heat pumps offer the potential of more efficient heating and cooling of buildings than conventional heat pumps, and they may be applicable in places where groundwater heat pumps and conventional geothermal development are not. Heat transfer occurs primarily by conduction making the thermal conductivity of the subsurface a critical factor in determining the performance of earth-coupled heat pumps. Thermal conductivity is dependent on porosity, moisture content, and the mineralogy of the solid phase. The cost of drilling or excavating into the subsurface and installing the system is an important element of the overall cost. Combining these factors with the annual range and distribution of temperature at the surface and the building's heating and cooling demand, the overall economic and technical performance of different designs can be evaluated.

12558 **(CONF-821217—1) In-situ study of attic loose-fill thermal insulation in residential application.** McElroy, D.L.; Yarbrough, D.W.; Graves, R.S. (Oak Ridge National Lab., TN (USA); Tennessee Technological Univ., Cookeville (USA). Dept. of Chemical Engineering). 1982. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE83004462.

From ASHRAE/DOE conference on thermal performance of building envelopes; Las Vegas, NV, USA (5 Dec 1982).

The extent of settling of loose-fill insulations with time is being studied in sixteen pre-instrumented attics in Bucyrus, Ohio. In February 1982 immediately after installation, measurements were made of insulation depths and densities in eight attics insulated with loose-fill cellulose and eight attics insulated with loose-fill fiberglass. Depth measurements were made one, three, and six months after installation and density measurements at six months to assess the degree of settling for the two products. The average depth of the cellulose decreased about 13% in six months, while that of the fiberglass decreased about 3.4% during the same period. Average density increases are consistent with these depth changes to within 10%. Monitoring of the 16 attics is continuing.

12559 **(CONF-821217—2) Measured effect of forced ventilation on house infiltration rate.** Levins, W.P. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 21p. NTIS, PC A02/MF A01. Order Number DE83004463.

From ASHRAE/DOE conference on thermal performance of building envelopes; Las Vegas, NV, USA (5 Dec 1982).

Tests were conducted over a period of 18 months at a house near Knoxville, Tennessee, to determine the effect of forced ventilation on the house infiltration rate. An outside-vented electric dryer was used as the power vent. The testing was carried out during a variety of weather conditions. The tracer gas technique using sulfur hexafluoride was employed to measure infiltration rates. A non-linear regression equation was developed based on measured data relating the change in the house infiltration rate to the vent rate. The equation has the form of an inverse exponential curve showing a greater increase in the infiltration rate of a tightly constructed house than of a loosely constructed house. Calculations were made for 17 cities across the United States showing the effect of a vented electric dryer on house HVAC energy consumption.

12560 **(DOE/CS/22004—T1) Designing for energy efficiency: a study of eight California state office buildings.** Moore, A.T. (ed.). (California Univ., Berkeley (USA). Dept. of Architecture). Jun 1981. Contract FG03-80CS22004. 67p. Sam Davis, AIA, Univ. of California, Berkeley.

The architectural implications of energy conscious design were investigated by comparing a series of office buildings designed under similar constraints by different architects. Conceptual/architectural issues are emphasized. Although the buildings were analyzed by computer modeling, the results were used only to reinforce other observations about building form and design. The details and explanations of the more technical comparisons are described in a technical appendix. (MHR) .

12561 **(LBL—15251) Integrated-circuit control for two-lamp electronic ballast. Final report.** Kohler, T.P. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 13p. NTIS, PC A02/MF A01. Order Number DE83004466.

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Circuitry is described for a solid-state, high-frequency fluorescent ballast designed to operate two F40 T-12 rapid-start lamps. The circuits are designed to be produced by hybrid integrated circuit (IC) technology. The signal components are produced on a single IC chip; the power transistors are attached to an alumina substrate. The initial IC version reduces the component count by about 50%. The cost of each IC in 500K lots is $0.70, replacing discrete parts costing $2.25. Additional savings of more than $1.00 per unit are realized by the decreased assembly time and improved reliability of the ICs. The system performance (two-lamp F40) was compared to the discrete version of the ballast and to an efficient core-coil ballast and found to be 6% less and 20% more efficient, respectively. The decrease in efficiency relative to the discrete version of the ballast is due to retaining some power to the filaments during operation in order to maintain normal lamp life.

12562 **(LBL—15252) Energy-efficient compact screw-in fluorescent lamp. Final report.** Morton, E.W. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 26p. NTIS, PC A03/MF A01. Order Number DE83004465.

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A compact fluorescent lamp has been designed and constructed which can replace an incandescent lamp. The lamp is slightly larger than a standard lamp (8 3/4 in. x 3 1/4 in.), but is designed to fit a majority of portable lamp applications. This version, with a core-coil ballast, results in a system efficacy of 54 lumens per watt, with a light output of more than 1800 lumens. This compares favorably with a 100-watt incandescent (17.5 lumens per watt and 1750 lumens light output). The color temperature of 3000°K is compatible with an incandescent lamp (2800°K). The color rendition index (CRI) is 84. With a solid-state ballast, the efficacy and light output could be increased by 20% (65 l/w, 2200 lumens) and could provide a direct replacement for a three-way, 150-watt incandescent lamp (15 l/w, 2200 lumens).

12563 **(ORNL/CON—69) Laboratory evaluation of the heating capacity and efficiency of a high-efficiency, air-to-air heat pump with emphasis on frosting/defrosting operation.** Miller, W.A. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 100p. NTIS, PC A05/MF A01. Order Number DE83005168.

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A high-efficiency, air-to-air split-system residential heat pump of nominal 3-ton capacity was instrumented and tested in the heating mode under laboratory conditions. Performance of the system was measured during steady-state, dehumidifying, and frosting-defrosting conditions, with major emphasis placed on the dynamic frosting operation of the system. The study encompassed an evaluation of system and component performance for ambient temperature levels betwen 8.3 and -8.3°C (47 and 17°F respectively) and for discrete humidity levels ranging from 50 to 90%. The heat pump coefficient of performance (COP) and capacity, measured at 4.4°C (40°F) as a function of time after system start-up, decreased with time because of frost accumulation on the outdoor heat exchanger but increased with increasing ambient relative humidity. At ambient temperatures less than 4.4°C (40°F), the COP and capacity degradations caused by frost formation increased with increasing relative humidity because of greater frost accumulation of the outdoor heat exchanger. Experimental results revealed that both unnecessary and late defrosting operations occur when a time-and-temperature defrosting control is used. Concepts of advanced defrosting controls that could feasibly reduce both frosting and defrosting losses were developed from experimental data. Frosting caused greater degradation of heating capacity than defrosting did. Cumulative frosting loss coefficients were calculated as a function of time, temperature, and relative humidity and are applicable to modeling of frosting losses calculated in a seasonal performance program.

12564 **(PB—83-100461) Survey of the international development in indoor climate control.** Levin, B. (Swedish Council for Building Research, Stockholm). 1982. 85p. NTIS, PC A05/MF A01.

The interest of research in indoor climate control origins essentially from the 1970s. The increase of energy prices has been the principal cause of the interest in installing computers and implementing automatic control in buildings. Today there exists no obvious way of receiving information about current research or terminated projects in this field. The purpose of this project has been to compile a survey of the international development in this field of research.

12565 **(PNL—4549) Issues in federal preemption of state appliance energy-efficiency regulations.** Fang, J.M.; Balistocky, S.; Schaefler, A.M. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 135p. NTIS, PC A07/MF A01. Order Number DE83004993.

The findings and conclusions of the analysis of the various issues involved in the federal preemption of state regulations for the DOE no standard rule on covered appliances are summarized. The covered products are: refrigerators, refrigerator-freezers, freezers, clothes dryers, kitchen ranges and ovens, water heaters (excluding heat pump water heaters), room air conditioners, central air conditioners (excluding heat pumps), and furnaces. A detailed discussion of the rationale for the positions of groups offering comment for the record is presneted. The pertinent categories of state and local regulations and programs are explained, then detailed analysis is conducted on the covered products and regulations. Issues relating to the timing of preemption of state regulations are discussed, as well as issues relating to burden of proof, contents of petitions for exemptions from preemption, criteria for evaluating petitions, and procedural and other issues. (LEW)

12566 **(PNL—4551) Barriers to household investment in residential energy conservation: preliminary assessment.** Hoffman, W.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 87p. NTIS, PC A05/MF A01. Order Number DE83004693.

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A general assessment of the range of barriers which impede household investments in weatherization and other energy efficiency improvements for their homes is provided. The relationship of similar factors to households' interest in receiving a free energy audits examined. Rates of return that underly household investments in major conservation improvements are assessed. A special analysis of household knowledge of economically attractive investments is provided that compares high payback improvements specified by the energy audit with the list of needed or desirable conservation improvements identified by respondents. (LEW)

12567 **(PNL—4552) Overcoming barriers to residential conservation: do energy audits help.** Hoffman, W.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 71p. NTIS, PC A04/MF A01. Order Number DE83004771.

A study on the effects of energy audits on the pace and choice of household investment in energy-saving improvements in the home is reported. An evaluation based on the household's assessment of the usefulness of the audit which was provided for their home was performed. The number and types of recent conservation actions among audited and unaudited samples of households are compared. The audit's effect on household knowledge about the economically attractive options for their home and on the choice of recent improvements is assessed. Possible reasons are suggested for the weak effect of audits in stimulating activity and reorienting investment choices. (LEW)

12568 **(TENRAC/EDF—027) Demonstration of a low-cost, indirect evaporative cooling system. Final report.** Dunn, J.R. (Texas Tech Univ., Lubbock (USA). Dept. of Mechanical Engineering). Nov 1979. 86p. NTIS, PC A05/MF A01. Order Number DE83900811.

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The objective of this effort was to evaluate the concept of a low-cost, indirect evaporative cooling system. Indirect evaporative cooling differs from conventional evaporative cooling in that instead of injecting the humidified air stream directly into the room, it is used to cool a dry air stream which subsequently cools the conditioned space. The advantage of this system is that the latter air stream is not humidified and is able to maintain comfort conditions without significant increases in room relative humidity. The key to this concept is the design and operation of the humidification-air cooling units so as to maintain room temperature at low cost. The first phase of the project was to perform an engineering design and performance evaluation of the indirect cooling concept. The cooling unit consisted of an evaporator section followed by a heat exchanger made of thin, lightweight, plastic sheets. Tests of cooler performance were performed at simulated outdoor temperatures of up to 105°F. For these tests, the unit was able to deliver cool air at a mean temperature of 75°. Evaluation of the complete results indicate that the concept has the potential to provide effective, low-cost space cooling in arid and semi-arid climates. The principal area requiring continuing investigation is that of the design of the heat exchange unit. Design recommendations have been identified which would significantly improve the performance of the unit. An extended application of the unit has also been identified in which the concept is operated with a rock bed storage system to provide storage for cooling during periods of optimum cooling conditions such as night time and thus lowering the size requirements for the unit.

12569 **(TENRAC/EDF—028) Characterization of supersorbent polymers for dehumidification. Final report.** Tock, R.W. (Texas Tech Univ., Lubbock (USA). Dept. of Chemical Engineering). Jan 1980. 39p. NTIS, PC A03/MF A01. Order Number DE83900812.

The findings of a study are reported in which the supersorbent polymer, H-SPAN (hydrolyzed starch-polyacrylonitrile) was evaluated as a means of controlling humidity in confined environments. Its equilibrium moisture capacity was found to be more than twice that of the traditional desiccants, Silica Gel and Activated Alumina, over the relative humidity range of 60% to 90%. Below a relative humidity of 60%, however, Silica Gel, Activated Alumina and H-SPAN gave essentially identical performance with regard to equilibrium sorption capacity. The H-SPAN polymer could be re-

generated at 120°F which is considerably below the 400°F required for the inorganic desiccants. This represents a savings in energy costs during the regeneration step. Although there are many parameters which might drastically affect performance, a selected hypothetical system indicates that the supersorbent polymer powder can be used to economically control humidity in enclosed environments. The predicted economic savings range from 1 or 2% to as much as 30% of the cost of operating a refrigeration unit. An additional requirement of the sorption system is that it must be coupled with an air cooling system to remove sensible heat entering the environment from sources within and without. This can be done by incorporating heating and cooling coils within the supersorbent bed. In any event the use of organic based sorbents to control humidity represents new technology which will require a considerable amount of development and marketing before it becomes a viable alternative for air conditioning practice.

12570 **(TENRAC/EDF—029) Demonstration ice storage with waste-heat-recovery project. Final report.** Shipper, K.E. (Lamar Univ., Beaumont, TX (USA). Coll. of Technical Arts). 6 May 1980. 48p. NTIS, PC A03/MF A01. Order Number DE83900813.

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The goals of the reported project were to: construct a compact, package-type cooling system; test ice storing capacity in relation to time, weight, and total energy consumption; design and install an ice bank system with heat recovery capacity in a residence; and meter and monitor the system in operation and compare with other systems in similar residences for energy consumption, material, and maintenance costs. An ice bank cooling system was laboratory tested and a working unit was installed in a new 3-bedroom house. The system consists of an insulated storage tank in which water is cooled by a commercial refrigeration unit during the night hours. During the day, the chilled water is circulated by pump to an indoor coil located in the air duct system. The heat exhausted by the refrigeration unit is captured by a heat exchange unit. Water is circulated through the heat exchanger and a water heater. Detailed information concerning the construction and installation of the system is provided, as well as data gathered during operation. (LEW)

12571 **(TENRAC/EDF—038-Vol.1) Groundwater-source heat-pump design development for Texas. Volume I. Resource. Final report.** Kreitler, C. (Texas Univ., Austin (USA). Bureau of Economic Geology). Apr 1980. 201p. NTIS, PC A10/MF A01. Order Number DE83900684.

For the potential user of a ground-water heat pump system, information is given on: locations of major and minor aquifers in Texas, the average depth to water for all aquifers, the average minimum depth to water by counties, the average water temperature for all aquifers by county, the average minimum water temperature for all counties, hydrologic descriptions of available ground water supplies in the major cities and towns through Texas, the potential for scaling and corrosion, and the general costs of well construction and pumping ground water. Legal aspects, environmental impacts, and alternate use constraints are considered. (LEW)

12572 **(TENRAC/EDF—041) Development of the commercial air conditioning with thermal-energy-storage concept: Phase I. Final report.** Bywaters, R.P. (Bywaters and Associates, Dallas, TX (USA)). 30 Mar 1981. 69p. NTIS, PC A04/MF A01. Order Number DE83900793.

Probable time-of-day rates, system concepts, and cost data were developed for two air conditioning with thermal energy storage (AC-TES) systems. These storage cooling units were sized to replace a conventional 35-ton DX rooftop condenser. Performance and economic analyses of these systems suggest that payback periods of 5 to 7 years can be obtained with this cooling concept, if electric utilities offer progressive time-of-day rates. Widespread adoption of the AC-TES concept by commercial and industrial users should result in about a 15% reduction in summer peak demand for a typical electric utility in Texas.

12573 **(TENRAC/EDF—051) Energy-conservation potential from optimized mass flow and temperature differences in cooling systems. Final report.** Bond, S.K.; Hart, M.N.; Bond, H.H. (Energy Engineering Associates, Inc., Austin, TX (USA)). 31 Aug 1981. 296p. NTIS, PC A13/MF A01. Order Number DE83900873.

An optimization strategy is developed for specifying the mass rate and temperature difference for given heat loads to minimize energy consumption. Energy savings potentials were quantified for a large class of existing structures which employ electric water chillers and air circulation fans to provide space cooling. The graphical results, along with instructions for their use, are presented. The format of presentation is designed to aid a building owner or operator in estimating savings, based on potential for simultaneous fan slowdown and chilled water temperature reduction.

12574 **(TENRAC/EDF—055) Development of a method to improve the efficiency of commercial and residential air-conditioning systems. Final report.** Green, T.F. (Radian Corp., Austin, TX (USA)). 20 Nov 1981. 61p. NTIS, PC A04/MF A01. Order Number DE83900820.

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The objectives of this project were: (a) to develop, test, and analyze a retrofit improvement in commercial air conditioning systems, and (b) to use commercially available equipment and existing labor skills in order to enhance near term adoption. The target application for this improvement is the commercial sector. However, simplifications to the improvement make it applicable to the residential sector also. To accomplish these objectives, four distinct efforts were required: design a prototype system to be used for testing; formulate a test plan and design an appropriate instrumentation system; install the prototype system and its instrumentation, monitor system performance; and evaluate the performance and economics of the system. The execution and results of each of these effects are described.

12575 **(TENRAC/EDF—059) Controlled testing of retrofit energy-saver-brand indirect evaporative cooling systems. Final report.** (Bywaters and Associates, Dallas, TX (USA)). 30 Nov 1981. 34p. NTIS, PC A03/MF A01. Order Number DE83900803.

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During the summer of 1981, field testing was performed on one brand of indirect evaporative precoolers for air-cooled air conditioners to verify that this type of accessory could effectively lower condenser air temperatures, and cause a significant reduction of power consumption for any given cooling load. Primarily, testing was done with a 15-ton air-cooled rooftop unit in Dallas, but a 5-ton residential unit was also tested. The results of these tests indicate that power demand and energy consumption can be reduced by approximately 7%. In addition, machine Energy Efficiency Ratio (EER) was improved and it was observed that this method of indirect evaporative cooling causes no coil damage or deterioration. Because of the untypically mild summer weather and various equipment problems, the range of test data is less than desired for a total understanding of this retrofit concept, and it is felt that significantly better results can be achieved under more controlled test conditions. However, based upon the data taken during this test sequence, it appears that commercial application of this type of evaporative precooler should result in an economic payback in the range of 4 to 5 years.

12576 **(TENRAC/EDF—067) Design evaluation of an improved indirect evaporative cooling system. Final report.** Dunn, J.R. (Texas Tech Univ., Lubbock (USA). Dept. of Mechanical Engineering). 28 Apr 1982. 62p. NTIS, PC A04/MF A01. Order Number DE83900876.

The results of an investigation of an improved indirect evaporative-cooling (IEC)system are presented. The study focused on a cooling system concept which combines an indirect evaporative-cooling unit with a conventional vapor-compression refrigeration system. In this system, initial cooling of outside air is performed in the IEC unit with additional cooling taking place across the evaporator coil of the conventional refrigeration unit before delivery to the conditioned space. The condenser coil rejects heat to the sec-

ondary (humidified) air stream of the IEC before it is discharged outdoors. A simulation model was developed to predict the performance characteristics of the concept for additional conditions beyond those used in the experimental test program. Principal output parameters from both the test program and simulation model included delivery air temperature, cooling capacity, and system COP.

12577 **(TENRAC/EDF—073) Residential comfort-conditioning options for the Texas Gulf Coast. Final report.** Mei, H.T.; Kavanaugh, S. (Lamar Univ., Beaumont, TX (USA). Dept. of Mechanical Engineering). 1 May 1982. 134p. NTIS, PC A07/MF A01. Order Number DE83900815.

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This project examines the energy features of an idealized single family residence for the Gulf Coast, with extensive consideration of water source heat pump options and supplementary residential energy conservation systems. This is further supported by an experimental effort in which an existing residence is retrofitted with a heat pump and other energy sources: well water as a heat source/heat sink/storage, horizontal buried metal and plastic ground coils to use as heat source/heat sink, and a solar assist system. The energy elements are operated individually and in combination configurations to determine performance, and cost effectiveness of the energy alternatives are explored.

12578 **(TENRAC/EDF—075) Non-residential groundwater-heat-pump retrofit demonstration. Final report.** Hildebrandt, A.F.; Bentley, J.; Ibrahim, A. (Houston Univ., TX (USA). Energy Lab.). 31 Aug 1981. 24p. NTIS, PC A02/MF A01. Order Number DE83900870.

Although groundwater heat pumps save energy over conventional air-to-air heat pumps, questions have risen as to whether this saving is sufficient to pay for the site specific cost of drilling a well. The goal of this project is to address the question through direct experimental comparison of the performances of heat pumps of each type, by alternately comfort-conditioning the same building space. Data gathered in this manner lead to energy and economic analyses of the differences. Precise measurements were made on a system at the Energy Laboratory which was retrofitted with a groundwater 3-ton heat pump-air conditioner and a 5-ton air-to-heat pump-air conditioner that has been modified to operate also in a water-to-air mode. Measurements spanning a period of months show that the air conditioning COP of the 3-ton water-to-air unit was 3.7. Measurements in the heating mode still need to be completed. These types of units provide for excellent retrofit operations where adequate well water or surface water is available, as in lake areas. The well water is not actually consumed but reinjected into the ground in a second well. This technology is available in off-the-shelf items. The heat pump-air conditioning units are commercially available in a variety of sizes. Excellent well water drillers and suppliers are also available in every locale in Texas.

12579 **(TENRAC/EDF—077) Demonstration of desiccant dehumidification components compatible with solar-powered residential cooling systems. Final report.** Howell, J.R. (Texas Univ., Austin (USA)). 1 Aug 1982. 95p. NTIS, PC A05/MF A01. Order Number DE83900872.

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The research reported here is an experimental study to determine the performance and economics of an alternative to presently available heat-driven cooling cycles. This alternative, called desiccant cooling, uses a drying agent (desiccant) to remove almost all of the moisture from outside air. In this work, the absorber, which is the particular part of the desiccant system that brings the air in contact with the desiccant while simultaneously providing cooling, has been tested. The results are compared with previously done computer models of the absorber behavior. The projected economics of the system are also examined, and the system is found to show promise against projected deregulated conventional energy costs.

12580 **(TENRAC/EDF—078) Groundwater-source heat-pump design development: consideration of locally variable factors. Final report.** Jones, J.W.; Maheshwari, N. (Texas Univ., Austin (USA). Center for Energy Studies). Aug 1982. 41p. NTIS, PC A03/MF A01.

A simulation model applied to an existing building in Austin, having an air-source heat pump, predicted with reasonable accuracy the actual electricity use. The model was also used to simulate, for comparison, the performance that a groundwater-source heat pump would have in that building. The performance of the groundwater-source heat pump over a range of depths to water, water temperatures, and heating/cooling loads was examined. The results give a sense of how local conditions might affect decisions to choose a groundwater-source or an air-source heat pump.

12581 **Heat driven heat pump using paired ammoniated salts.** Dunlap, R.M. US Patent Application 6-182,367. 29 Aug 1980. 14p.

A cycle for a heat driven heat pump using two salts $CaCl^2.8NH^3$, and $ZnCl^2.4NH3$ which may reversibly react with ammonia with the addition or evolution of heat. These salts were chosen so that both ammoniation processes occur at the same temperature so that the heat evolved may be used for comfort heating. The heat to drive the system need only be slightly hotter than 122 C. The low temperature source need only be slightly warmer than 0 C.

3202 Transportation

12582 **(CONF-7807110—) Effects of energy constraints on transportation systems: proceedings of the fifth national conference.** Mittal, R.K. (ed.). (Union Coll., Schenectady, NY (USA)). Dec 1982. Contract FG01-78CS54260. 450p. NTIS, PC A19/MF A01. Order Number DE82022190.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Portions of document are illegible. Printed copy available until stock is exhausted.

Twenty-eight papers are included. A separate abstract was prepared for each one. (MHR)

12583 (CONF-7807110—, pp II.1-II.15) **Effects of urban development patterns on transportation energy use.** Cheslow, M. (Urban Inst., Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The relationship amongst urban form, transportation, and the use of energy is covered. The energy crunch has motivated such studies with a veiw to get some guidelines for reducing travel within an urban area. Quantitative relationships are developed between the use of the energy and transportation demand under the several sets of environments. It is expected that such quantitative relationships shall be used by the policy makers with a view to reduce travel and thus the use of energy.

12584 (CONF-7807110—, pp II.16-II.37) **Transportation energy: an overview, with emphasis on New York State.** Hartgen, D.T. (New York State Dept. of Transportation, Albany). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

An overview of the energy aspects of the New York State Transportation Sector is provided. Energy supply and demand statistics are presented for the New York State and for the United States. Attempts have also been made to provide energy forecasts for up to the year 2000 with and without the inclusion of conservation strategies. An analytical approach is provided to estimate automotive fuel use as a function of gasoline price and supplies and several other factors concerning the economy and general population growth. Public views and behavioral response to the energy crisis are presented.

12585 (CONF-7807110—, pp II.38-II.56) **Overview of transportation energy methodologies.** Mouchahoir, G.E. (MITRE Corp., McLean, VA). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Energy and transportation related issues and methodologies are presented. Each methodology is described as to procedure, assumption, input and output parameters, and its advantages and disadvantages. These methodologies were grouped according to their level of emphasis - aggregate, site specific, or detailed considerations. It is indicated that there are two major areas of weakness common to these methodologies: lack of reliable data and lack of analytical tools. It is also indicated that care should be exercised in using data and methodologies by recognizing the inherent assumptions and inaccuracies which prevail.

12586 (CONF-7807110—, pp III.10-III.20) **Alternative fuels - where we are today and where we need to go: status of technology, issues, requirements for R and D.** Timbario, T.J. (Mueller Associates, Inc., Baltimore, MD). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Currently a great deal of attention is being given to alternative fuels. As the prices of the crude oil go up, the allocation of resources towards the alternative fuels become even more justifiable. Admittedly, there is a considerable lead time required to achieve the kind of technology we need for the production and distribution of alternative fuels. Following are discussed: the status of technologies, requirements for continued R and D and prognosis for the future. It is concluded that the alternative fuels shall play a major role in the years ahead.

12587 (CONF-7807110—, pp IV.1-IV.16) **Intercity freight movement and energy issues.** Sherard, T.D. (Western Highway Inst., San Francisco, CA). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Energy aspects of intercity freight movement are presented. In 1975, a total of 590 billion ton-miles of freight were hauled by motor carriers. 450 billion ton-miles were intercity freight. By 1990, total motor carrier freight is expected to increase to 880 billion ton-miles. It is expected that more than 20 billion gallons of fuel shall be required just to haul intercity freight in the year 1990. Several strategies such as air-drag reduction devices, smooth side trailers, radial tires, thermostatic fans, and high torque engines can be successfully deployed to reduce the energy consumption. Although considerable gains are possible towards the goal of reduction energy, these potential gains are being hampered by government vehicle standards for emissions, noise vibration, and other truck-related equipment and operating procedures.

12588 (CONF-7807110—, pp IV.17-IV.35) **Least-energy operation of river shipping.** Marbury, F. (Ketron, Inc., Arlington, VA). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The line-haul phase of river shipping is covered. Methods have been derived for determining the best speeds at which to operate river shipping equipment in order to minimize fuel consumption per mile, (or per barge-mile, or per ton-mile), or to minimize line-haul cost per mile, etc. These best speeds depend on equipment propulsive performance and costs, whether bound upstream or downstream, swiftness of current, and depth of water. This methodology will prescribe a best speed for each reach of a river, given the equipment used, its fuel rates and costs.

12589 (CONF-7807110—, pp IV.36-IV.53) **Prospects for energy conservation in the pipeline industry.** Banks, W.F. (Engineering Management and Development, Inc., San Diego, CA). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Because of the energy considerations, the pipe-line industry is gaining a new momentum. The current findings show that the pipe-line industry uses less energy than the competing modes of transportation. This paper is meant to: characterize the pipe-line industry, identify opportunities for energy conservation in the pipeline industry and assess the future potential of the pipe-line industry for growth and for contribution to the national goals of conservation of energy and of petroleum based fuels.

12590 (CONF-7807110—, pp IV.54-IV.55) **TOFC shuttle trains vs. double trailer trucks.** Brigham, T.B. (Massachusetts Inst. of Tech., Cambridge). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The objectives of this research is to determine the transportation market consequences in an environment in which two competitive modes, TOFC shuttle trains and double-trailer trucks, are allow to compete freely. Both the demand and the supply sides are analyzed. A model of the decisions made by individual managers responsible for logistics is used on the demand side. For each firm, it is possible to hypothesize a logistics cost maintenance of an inventory for each of the inputs used in the production process. Such a logistics cost function contains elements for placing an order, transporting the goods, distributing and storing them, paying interest on the money invested, and incurring such costs as would accrue with a stockout of these goods. The logistics cost function is minimized through simulating the manipulations of the decision-maker of certain choice variables. These include the location of point of purchase or acquisition of the product, the decision on when to reorder and in what size of shipment, and finally, the mode to be used for the transport. This model of demands by individual decision-makers is used to analyze a sample of the population of shippers within three major transportation corridors in the United States: Philadelphia-Cleveland, San Francisco-Los Angeles, and Chicago-Houston. The decisions of the individual decision-makers are aggregated for each of the policy options under consideration, and a comparison is performed with the base case for each corridor. The results give an indication of the shipper response to each of the options. A subsequent analysis of the carrier reaction to each of these shipper responses is then undertaken.

12591 (CONF-7807110—, pp V.1-V.35) **Studies of energy efficient advanced transport aircraft for beyond 1990.** Conner, D.W. (NASA, Hampton, VA). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Although air transportation is the most convenient way of travel for mid to long distance city-pairs, it suffers from the fact that it is the most energy intensive mode of transportation. Consequently, considerable efforts are underway towards improving the energy efficiency of air systems. The problems and possibilities for improving the air system in terms of less congestion, increased speeds, and less energy use are discussed. The discussion pertains to the time-frame of 1990 and beyond. It is concluded that the prospects are bright for satisfying the transportation demands of the public with aircraft which not only will have greatly improved capabilities but also will operate efficiently in their use of energy.

12592 (CONF-7807110—, pp V.36-V.74) **Aircraft/air carrier energy conservation measures, status and operational constraints to additional implementation.** Adams, R.J. (Systems Control, Inc., West Palm Beach, FL). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The purpose of this paper is to acquaint individuals involved in the energy and air transportation fields with work performed for the Department of Energy Office of Conservation and Environment on the Fuel Efficient Activities of Aircraft and Air Carriers. The discussion presented briefly summarizes the various energy conservation options available to the air carriers and classifies these options by categories of flight operations, maintenance, ground operations, and flight planning. Each category is then examined for its

current implementation status and the operational constraints which curtail further implementation. The operational constraints discussed include ATC, FAA, CAB and FEA considerations and regulations. Following this discussion, a summary of fuel savings achieved by air carrier groups is presented. CAB performance data from 1972 to 1975 were used to determine changes in various energy efficiency measures such as ASMPG (Available Seat Miles Per Gallon), RPMPG (Revenue Passenger Miles Per Gallon, and TFC (Total Fuel Consumed). Following the general discussion of energy conservation by air carrier group, the domestic trunk performance is examined for seven types of aircraft - 4EWB (Four Engine Wide Bodied), 4ERB (Four Engine Regular Bodied), 3EWB (Three Engine Wide Bodied), 3ERB (Three Engine Regular Bodied), 2ETF (Two Engine Turbofan), 4ETJ (Four Engine Turbojet), and 4 ETP (Four Engine Turboprop). The historical analysis of energy conservation options and past performance is followed by a detailed discussion of the current barriers to additional fuel savings and an assessment of the implementation status of the various energy conservation options for each of the air carrier groups.

12593 (CONF-7807110—, pp VI.1-VI.12) **Automotive fuel economy - improvement potentials and strategies: manufacturer's viewpoint.** Hyde, A.P.S. (General Motors Technical Center, Warren, MI). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Automobiles consume more than 50% of the transportation energy budget. Consequently, there is a potential for considerable gain by deploying conservation strategies towards the auto sector. The manufacturer's viewpoint regarding the potential viability of several energy conservation strategies is discussed. Also discussed are the impacts of several government regulations upon the fuel efficiency of cars. The possibility of using alternate power plants is also described.

12594 (CONF-7807110—, pp VI.13-VI.31) **Nature and characteristics of federal fuel economy standards.** John, R. (Transportation Systems Center, Cambridge, MA). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

This presentation discusses the role of the federal government towards the goal of fuel efficient, safer and less polluting auto transportation. Comprehensive discussion of the federal regulation in regard to the fuel economy is provided. The presentation also highlights the petroleum savings resulting from the introduction of new federal fuel economy standards. A brief review of the related activities which are presently being carried out at the Transportation System Centre is also provided. The presentation culminates with the discussion of the future direction of federal fuel economy standards.

12595 (CONF-7807110—, pp VI.32-VI.39) **Impact of fuel regulations in automotive design and manufacturing.** Hurter, D.A. (Arthur D. Little, Inc., Cambridge, MA). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The concept of segmentation and how that concept applies to the automobile industry are discussed. Arthur D. Little has been evaluating life-styles and cultural values of the citizens of the United States for some years. The population is segmented in a variety of ways; by size of household and demographics as well as by age, income and martial status.

12596 (CONF-7807110—, pp VII.1-VII.21) **Energy efficiency: which modes, which programs.** Kulash, D.J. (Congressional Budget Office Natural Resources and Commerce Div., Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The framework is provided for comparing and evaluating the energy consumption of urban transportation modes. Both direct as well as indirect components of energy are discussed. Estimates for various measures of energy requirements by urban transportation modes are provided in a tabular form. Vanpools display the best performance on all measures, while dial-a-ride shows up worst. Buses and carpools also perform consistently well. Most rail transit does quite well on operating energy intensity and even line-haul energy. When the effects of access energy and circuity are added in, however, the ranking of rail transit drops considerably. Old heavy rail transit also appears as one of the most efficient modes even after access energy is included. This is largely because of its location in older, more densely populated areas.

12597 (CONF-7807110—, pp VII.22-VII.30) **Carpools and vanpools - potential for major energy savings.** Pratsch, L. (Dept. of Energy, Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The savings resulting due to the deployment of vanpools are presented. Although the energy potentials are great, their savings have not been realized because of institutional issues. A comprehensive literature relative to the background and growth of vanpools is provided and recommendations are made for their expansion. Finally, it is recognized that if the United States is able to adapt a comprehensive vanpool policy, the resultant impact upon importation of oil would be definitely positive.

12598 (CONF-7807110—, pp VII.31-VII.42) **Strategic factors influencing public investment in energy efficient mobility: load factors in vehicles, capital requirements for innovation, urban design constraints, market behavior.** Gray, A.R. (Urban Transportation Development Corp., Ltd., Toronto, Ontario). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The strategy for achieving energy savings by the coordination of transportation facilities with urban development is examined. Many of the high density buildings are located in areas of high accessibility or in concentrations large enough to create their own mini corridor and thus attract supporting services. But there has been little coordination in the planning of these housing and transportation facilities. Quantitative evaluation of several scenarios discussing energy and related impacts is presented.

12599 (CONF-7807110—, pp VII.43-VII.63) **BART's energy consumption and costs: a comparative analysis.** Ellis, R.H.; Sherret, A. (P.M.M. and Co., Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

BART'S energy consumption is compared to that of other rail rapid transit systems and a partial analysis of energy consumption of BART, bus, and automobile in one travel corridor of the Bay Area using recent data on actual passenger volumes is included. BART'S operating costs and revenues are briefly summarized and compared to data for other transit systems.

12600 (CONF-7807110—, pp VII.64-VII.72) **Costs and benefits of energy consumption by public transit.** Hamilton, W. (General Research Corp., Santa Barbara, CA). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Transit energy efficiency depends significantly on drastic changes in our cities and our styles of life. Quality of service parameters such as travel-time, cost, comfort and convenience are far more important than a gallon of gas saved. It is believed that the quality of life is sure to be strongly influenced by transportation which supports or requires major overhauls of urban form. Service, cost and the quality of life leads to no final conclusions, but strong-

ly suggests that in debates solely discussing energy savings, we are letting the tail wag the dog. It is concluded that expensive new transit, government suppression of automobiles and denser urban areas are the only way, not necessarily the best way to save energy. Even if correct calculations of Btu's saved per passenger-mile are finally agreed upon, they will probably disclose a secondary, not primary impact. The importance of service, cost and the many affected qualities of life appear so important when they are properly evaluated, energy savings will probably seem a minor factor in ultimate choices.

12601 (CONF-7807110—, pp VII.73-VII.84) **America's overlooked energy resource: the intercity bus.** Bade, N.E. (Greyhound Lines, Inc., Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

This presentation is meant to expand upon the viewpoint of the intercity bus industry towards the energy crunch. Most of the experts agree that the bus is the most fuel efficient form of transportation but still its overall role is very minimal. Buses serve 90% of all communities with 2500 to 5000 inhabitants. The bus system also carries far more people than all the airlines and Amtrak combined. The low income, and persons over 55 and under 18 years of age have the most use of the bus. Aside from the energy efficiency aspects, the intercity bus is less polluting and the safest mode of travel. In spite of all this, the bus industry has not attracted the attention of the policy makers at the Department of Transportation. It is also recognized that the bus industry is hurt by an image problem which stems in large part from the industry's need to modernize and relocate many terminals. Part of the solution towards revitalizing the bus industry lies in building truly multimodal transportation centers to be shared and paid for by all modes using them.

12602 (CONF-7807110—, pp VIII.1-VIII.16) **Transportation energy savings from a national conservation program: a case study of Pennsylvania.** Chan, Y. (Pennsylvania State Univ., Philadelphia). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Pennsylvania is an active participant in the Energy Policy and Conservation Act (EPCA) program and it is required that the state's energy demand be reduced by at least 5% by the year 1980. This paper sheds some light on the transportation elements of the act and the program recommended by the Pennsylvania Department of Transportation. The major thrust of the paper is to evaluate the alternative conservation measures and to make some comments on the Pennsylvania plans vis-a-vis the national scenario as a whole.

12603 (CONF-7807110—, pp VIII.17-VIII.19) **Perspectives on states' transportation energy conservation plans.** Ozarow, V. (New York State Energy Office, New York). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The role of the State Energy Office in New York is described. Its major role is devising energy plans for the state. This office is supported almost exclusively by federal funding.

12604 (CONF-7807110—, pp VIII.20-VIII.25) **Perspectives on states' transportation energy conservation plans.** Peyerbrune, H. (New York State Dept. of Transportation, Albany). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The role of New York State Department of Transportation towards the conservation strategies and/or policies directed towards the transportation sectors are presented.

12605 (CONF-7807110—, pp VIII.26-VIII.29) **Energy impact of FAA regulations and operating procedures: an operator's viewpoint.** Cooke, R.A. (National Business Aircraft Association, Inc., Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Methods are suggested to improve fuel economy in aircraft for business and corporate use. Ways to conserve fuel and still obey FAA regulations are described. (MHR)

12606 (CONF-7807110—, pp VIII.30-VIII.32) **Airlines and fuel conservation: doing more with less.** Duba, J.G. (Air Transport Association of America, Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

Progress in fuel conservation is reviewed using material from an Air Transport Association report, and comments from airline representatives. (MHR)

12607 (CONF-7807110—, pp VIII.33-VIII.40) **Strategies for saving airline fuel.** Flener, W.A. (Dept. of Transportation, Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The FAA seven-point jet fuel conservation plan, implemented in 1973, is presented. Intermediate-term fuel conservation alternatives investigated are listed. New procedures initiated since 1973 for fuel conservation are discussed. (MHR)

12608 (CONF-7807110—, pp VIII.41-VIII.42) **Energy conservation - pilot's viewpoint.** Ober, R. (Pan American World Airways, New York, NY). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The problems involved in trying to save fuel are discussed briefly, as follows: fuel tankering, air traffic control, and flight management systems. (MHR)

12609 (CONF-7807110—, pp VIII.43-VIII.58) **Transportation contingency planning.** Davis, S.; Difiglio, C. (Dept. of Energy, Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The various ramifications of gasoline rationing as a contingency plan are explored. The plan proposed uses vehicle ownership as the basis for allocation of ration rights to consumers as opposed to possession of a driver's license. A white market concept is included which makes it possible for consumers to freely market their ration rights, buying or selling these rights depending on their consumption patterns.

12610 (CONF-7807110—, pp VIII.59-VIII.73) **Transportation conservation: can we deliver.** Berwager, S.D. (Dept. of Energy, Washington, DC). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

The overview of the conservation strategies directed towards the transportation sector is described briefly. Some quantitative information is provided in regard to the balance of payments which are expected to grow to 100 billion dollars by the year 1985. The fact that although this country had an oil embargo in 1973, no constructive steps have been taken to reduce our dependence upon imported oil is expanded upon. Some of the recent Presidential and legislative actions have been described. It is admitted that the solu-

tions are not easy and the related impacts are not clear. Some of the short-term conservation options are also listed. Also, described is a comprehensive list of R and D projects currently engaged in by the Department of Energy.

12611 (CONF-7807110—, pp IX.1-IX.21) **Energy intensity of various transportation modes.** Mittal, R.K. (Aerospace Corp., Los Angeles, CA). Dec 1982. NTIS, PC A19/MF A01.

From 5. national conference on effects of energy constraints on the transportation systems; Schenectady, NY, USA (31 Jul 1978).

An overview of the existing literature related to Energy Intensity (EI) of various transportation modes is provided. These transportation modes include intracity (auto, bus, automated guideway transit system, vans, heavy rail, and light rail transit), and intercity (airplanes, autos, buses, trucks, rail, waterways and pipelines) modes of transportation for passenger and freight movement. Wherever possible, an attempt has been made to correlate energy intensity as a function of operating conditions such as speed, load factor, type of commodities being moved, etc. Use of both statistical and engineering approaches has been made for estimating energy intensity figures. It is concluded that energy intensity values have a considerable range depending upon the operating conditions, types of hardware, trip characteristics, load factor and types of commodities being shipped. The major output of the study is a list of suggested EI values (in tabular form) for several transportation modes.

12612 (DOE/CS/50108—1) **Maintaining automotive mobility: using fuel economy and synthetic fuels to compete with OPEC oil. Final report.** Shackson, R.H.; Leach, H.J. (Mellon Inst., Arlington, VA (USA). Energy Productivity Center). 1 Mar 1982. Contract AC02-79CS50108. 101p. NTIS, PC A06/MF A01. Order Number DE83004873.

Two strategies for reducing the cost and increasing the reliability of the automotive transportation system are the improvement of fuel economy and the production of nonpetroleum fuels. The options are investigated for implementation of these strategies over the next 20 years, and the strategies are compared. The study methodology has three major components: an estimate of the costs of improving automobile and light truck fuel economy, an estimate of the cost of producing synthetic fuels for transportation, and subjecting these estimates to the scrutiny and criticism of a steering group composed of experts in the relevant fields. The methodology and data used to compute new automobile and light truck fuel economy, fleet fuel consumption, capital requirements, and consumer costs, under different scenario assumptions for the years 1980 to 2000 are described. The baseline technology and fleet characteristics are discussed, followed by a description of the automotive technology. The effects of introducing new technologies into the car and truck fleet are examined based on several scenarios, followed by a sensitivity analysis. (LEW)

12613 (DOE/IR/11160—T1) **National conference for bicycle program specialists. Final report.** Moran, K. (Bicycle Federation, Washington, DC (USA)). Jul 1981. Contract FG05-80IR11160. 17p. NTIS, PC A02/MF A01. Order Number DE83004281.

The National Conference for Bicycle Program Specialists was conducted in order to provide a forum for the exchange of information and ideas on bicycle program activities and to enhance the skills of bicycle program specialists. The planning and results of the conference, as well as post conference activities, are described. (LEW)

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 11687, 11785, 11808, 11822, 11968, 11972, 12041, 12064, 12088, 12524, 12637

12614 (CONF-821101—16) **Study of heat and mass transfer in a vertical-tube evaporative cooler.** Perez-Blanco, H.; Bird, W.A. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 24p. NTIS, PC A02/MF A01. Order Number DE83003480.

From ASME winter annual meeting; Pheonix, AZ, USA (14 Nov 1982).

Evaporative coolers are three-fluid heat exchangers employed for heat rejection to the environment. A mixture of air and recirculating water is used as the cooling medium. These coolers are considered viable routes for improving thermal efficiencies of power-generating and referigeration cycles. The heat- and mass-transfer processes taking place in a vertical-tube evaporative cooler are studied. A steady-state, one-dimensional model of cooler performance is formulated. This model is validated by experimental measurements, taken in a single-tube exchanger, of the controlling heat- and mass-transfer coefficients. These coefficients occur at the air-water interface. Heat fluxes and enhancement ratios for conditions of interest are measured and calculated, and the results are compared and discussed. The model is found to adequately predict heat-exchanger performance.

12615 (CONF-8108141—, pp 269-293) **Experiences and data of a German 7-million lbs/hour 500 MW co-generation system.** Walter, K. Mar 1982. NTIS, PC A21/MF A01.

From 8. annual international conference on coal gasification, liquefaction, and conversion to electricity; Pittsburgh, PA, USA (4 Aug 1981).

Combined heat and power generation in Germany can look back on a long tradition, particularly in industries having high heat requirements, such as the chemical, paper and sugar industries. Industrial power generation, roughly one-half in the form of co-generation and one-half pure electrical generation, accounted up to 1962 for approximately 38% of all power generated. This percentage has steadily dropped since then to the current level of 18%. This development is due to a variety of reasons: (1) Combined industrial heat and power generation in Germany represents an ideal complement to public electrical generation. The greatest electricity demand peaks occur in winter, that is to say, at times when the electricity generated through co-generation systems is at its maximum, due to the high heating energy demand. (2) For a long time, the technical developments in co-generation ran parallel to the technology of public electricity generation, and were even able to provide valuable contibutions to the latter, owing to the more favorable competitive conditions. The reasons here were the higher acceptable specific investment costs for industrial power generation as opposed to public power generation. This comes from the fact that no additional power transport costs occur in the case of co-generation and that the number of operating hours per year is normally much higher. (3) The major fuel savings of co-generation, requiring approx. 40% of the heat needed for condenser-type power stations, reduces environmental pollution to the same extent. (4) Industrial self-generation increases the supply security of a plant considerably.

12616 (CONF-8203103—, pp 10p, Paper 12) **Alternatives of the industrial energy planner.** Masciantonio, P.X. (United States Steel Corp., Pittsburgh, PA). 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

The energy crisis associated with the events of the 1970s has resolved to a period of relative stability. The crisis is over; however, the long term energy situation of supply interruptions, escalating energy prices, and diminishing resources has not changed. We cannot afford to become complacent during this period but instead, need to evaluate our present position and effectively respond to the long term situation. Reactions by government and industry during the past decade have not been particularly effective and have resulted in a distorted energy situation characterized by inconsistent policies, nonproductive use of resources, and confused planning alternatives. To rectify this situation requires a comprehensive determination of our needs, deliberate policy planning, and responsible assessment and implementation of alternative energy strategies. In this regard, the industrial energy planner has a unique position and responsibility. He is in a position to determine future conditions, identify energy alternatives, evaluate and implement these alternatives and communicate information to influence public opinion and public policy. He must continue to capitalize on the progress we have made and correct the distortions in our energy perspective. The energy alternatives available to us and our energy future

depend to a great extent on the ability of the industrial energy planner to define a realistic energy environment and to develop both internal and external systems and support to implement responsible energy strategies.

12617 **(DOE/AF/92017—T2) Distilling alcohol with waste automobile heat. Final report.** Reinke, R. (Reinke (Ralph G.), Wausau, WI (USA)). 30 Jun 1982. Contract FG02-81AF92017. 11p. NTIS, PC A02/MF A01. Order Number DE82018727.

Portions of document are illegible.

The project reported was to develop a device that will utilize the waste heat of an automobile for the production of alcohol fuel. Waste heat is obtained via heat exchanger on the exhaust pipe and one on the radiator fluid line. Operation is by automatic control. Instillation of the unit is found to be too difficult. Administrative details regarding permits to distill, obtaining raw stock, and tax rules are discussed. (LEW)

12618 **(DOE/CS/24448—T1) Third-party financing: increasing investment in energy-efficient industrial projects.** (Alliance to Save Energy, Washington, DC (USA)). Nov 1982. Contract FG01-80CS24448. 123p. NTIS, PC A07/MF A01. Order Number DE83003921.

Four considerations in structuring a third-party financing approach are discussed. These are financing advantages, risk management, tax implications, and operating arrangements. The four basic third-party financing approaches discussed are leasing, joint venture, shared-savings plan, and energy services contract. Each approah differs in terms of financing advantages, risk management, tax implications, and operating arrangements, and can be structured to provide benefits to all participants, it is found. A case study analysis of a major industrial firm considering an actual energy investment was conducted. (LEW)

12619 **(DOE/CS/40095—T1) Energy utilization in tire manufacturing. Final report.** Hale, L.A.; Collins, G.; Johnson, W.C. (Texas A and M Univ., College Station (USA). Research Foundation). Oct 1979. Contract AS05-77CS40095. 96p. (ORO—5478-1). NTIS, PC A05/MF A01. Order Number DE82021237.

Objectives of the reported study were: to examine the operation of a specific tire manufacturing facility to establish a data base descriptive of the operating characteristics of each process in the tire manufacturing procedure; to examine the processes in order to identify possible energy conservation opportunities; and to subject the identified conservation opportunities to detailed feasibility analyses. Recommendations are then made regarding plant operations, manufacturing technology, and plant management. (LEW)

12620 **(DOE/CS/40327—T3) Development and demonstration of an electric heat pump for waste-heat recovery in industry. The selection of working-fluid candidates for use in high-temperature industrial heat pumps. Topical report, September 1977-December 1978.** Snyder, P.H.; Moreland, W.C. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 1978. Contract AC07-77CS40327. 104p. NTIS, PC A06/MF A01. Order Number DE83003725.

The development of a high-temperature industrial heat pump depends upon the identification of an acceptable working fluid. An extensive search was made to select potential candidates meeting certain appropriate physical and hazard requirements. These candidates were then evaluated in detail with respect to their thermodynamic and economic performance as well as their relative health and safety aspects. Four fluids - methanol, thiophene, hexane, and Fluorinol 85 - are recommended as acceptable candidates for high-temperature heat-pump duty over the temperature range of approximately 180 to 330°F (80 to 165°C). Assuming the thermal stability and chemical compatibility of methanol are substantiated in the concurrent materials test program, it is the fluid of choice because its use results in the lowest thermal-delivery cost.

12621 **(DOE/CS/40327—T4) Development and demonstration of an electric heat pump for waste-heat recovery in industry. Preliminary design report.** Moreland, W.C.; Eder, J.S.; Wolfe, R.W. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 30 Mar 1981. Contract AC07-77CS40327. 162p. NTIS, PC A08/MF A01. Order Number DE83003594.

Portions of document are illegible.

A high-temperature heat pump is being developed for demonstration of waste-heat recovery in industry. The design of a prototypical unit to be used to recover heat from the vapor effluent of a thermomechanical pulping unit in a paper mill is outlined. The output capacity of the unit is 30 x 10^6 Btu/h in the form of process steam delivered at 50 psig with 20°F superheat (318°F). A functional description of the heat-pump system is given along with a thermodynamic analysis of the cycle. The various subsystems, controls, and major components are also described and a safety analysis presented.

12622 **(DOE/R5/10247—1) 600-watt free-piston Stirling engine generator. Final report.** (Sunpower, Inc., Athens, OH (USA)). 1981. Contract FG02-80R510247. 15p. NTIS, PC A02/MF A01. Order Number DE83004387.

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The prototype free-piston Stirling-engine alternator has achieved 500 watts of power, 50 Hz, at average 500°C heater head temperature on a solid fuel burner. Using standard scaling procedures, this machine will produce 780 watts, 60 Hz, at 700°C. At this time, modifications are underway which will raise power and frequency to predicted levels. Additional tests are planned and a 2nd-generation design has been started. Future commercialization plans are described.

12623 **(NYSERDA—82-18) Fluidized-bed retofit study of C-E VUX-type boiler at the Jamestown Board of Public Utilities Carlson Station, Jamestown, New York.** (Combustion Engineering, Inc., Windsor, CT (USA)). Jan 1981. 162p. New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, New York 12223.

Portions of document are illegible.

The objectives of this study was to evaluate the feasibility of retrofitting an existing coal-fired industrial steam generator with a fluidized bed combustion system. This included establishing a preliminary design in sufficient detail to develop a cost estimate associated with all major hardware additions and changes. The unit selected as a basis for this study is a Combustion Engineering VUX type steam generator rated for 150,000 lbs/hr steam. The unit is located at the Jamestown, New York, Carlson Station. As a preliminary step in the feasibility evaluation a site survey was conducted to determine suitability based on existing structures, open area, accessibility, and boiler condition. An evaluation and preliminary design was developed incorporating the fluidized bed into the existing furnace area, detailing all pressure part requirements. Design requirements were established for auxiliary systems and components. The incineration of industrial wastes generated by the local industry was investigated. Provisions for firing both solid and liquid industrial waste were incorporated into the retrofit design. Environmental consideration for both coal and waste firing have been identified. The results of the feasibility study showed that industrial boilers of the type studied can be retrofitted with a coal-fired fluidized bed combustion system achieving the desired performance and meeting the environmental requirements. The retrofit also provided for the utilization of industrial waste as a supplemental fuel source and the disposing of such waste in an environmentally acceptable manner. The cost of the retrofit was estimated to be $55.17 per lb of steam in 1980 dollars.

12624 **(PB—82-256835) Application of ozone to eliminate tertiary treatment of wastewater used for industrial cooling. Final technical report.** Merrill, D.T.; Parker, D.S. (Brown and Caldwell, Walnut Creek, CA (USA)). Feb 1982. 61p. NTIS, PC A04/MF A01.

Study was undertaken to determine whether the beneficial performance of ozone (biofouling, corrosion, and chemical scaling control), when used as the sole source of cooling water treatment for air-conditioning systems, could be obtained at higher cooling

water temperatures typical of industrial cooling with secondary municipal effluent (SME) used as the cooling medium. A pilot cooling system was constructed, and a 6-month experimental study initiated to determine process limits, mechanisms of scaling inhibition by ozone, and to evaluate factors influencing technical/economic feasibility. It was found that, while ozone use adequately controlled corrosion and biofouling, chemical scaling could not be prevented at conditions necessary for significant economic justification. Calculations indicate that the makeup waters (SME) used will become saturated with respect to calcium phosphate at less than 2 cycles of concentration; hence, a scaling potential exists at conditions less stringent than those used in the present study. It is recommended that ozone for scaling elimination in recirculating industrial cooling systems be dropped from further consideration where the makeup water is SME.

12625 **(PB—83-102327) Energy efficient industrial technology in Europe: a compendium. Interim report May 79-Feb 82.** Fassbender, A.G.; McGee, M.J. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1 May 1982. 160p. NTIS, PC A08/MF A01.

Energy efficient industrial technologies currently in use in Europe are described. The study concentrated on gas-fired equipment in West Germany, France, and the United Kingdom. Some of these technologies are unique and some are currently available in the United States. More detail on the best of these technologies will be available in a future report.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 12543, 12614

12626 **(CONF-8011101—8) Nashville Electric Service cogeneration energy-recovery facility.** Mittwede, H. (American Public Power Association, Washington, DC). 1980. 33p. American Public Power Association, 2600 Virginia Avenue, Washington, DC.

From American Public Power Association legal seminar; Boston, MA, USA (10 Nov 1980).

Portions of document are illegible.

The project discussed contemplates the burning of solid waste as a fuel to produce steam and electricity and sell these power sources commercially as an alternative to disposing of refuse in sanitary landfills. A feasibility study is summarized, and the project funding, legal, and political aspects are discussed. (LEW)

12627 **(DOE/CS/20009—1) Tacoma refuse-fired combustor feasibility study.** (Tacoma, City of, WA (USA)), Jan 1983. Contract AC06-77CS20009. 29p. NTIS, PC A03/MF A01. Order Number DE83005124.

A study of the densification of refuse derived fuel (RDF) is outlined. The study examined: densification methods and equipment, the purchase and adaptation of a densifier unit to operate with an existing resource recovery system, operating experience and modifications of the unit to adapt it to RDF, and actual manufacturing and burning of densified RDF in industrial waste fuel boilers and waste fuel gasifiers. Test burning was performed at a Washington pulp and paper plant. In addition, densified RDF was tested in three separate waste fuel gasifiers. (LEW)

12628 **(DOE/CS/20009—2) Tacoma refuse-fired combustor study. Phase II. (RDF densification study).** (Tacoma, City of, WA (USA)). 10 Sep 1982. Contract AC06-77CS20009. 36p. NTIS, PC A03/MF A01. Order Number DE83004897.

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The study of the densification of refuse derived fuel (RDF) examined several areas, including: investigation of densification methods and equipment, the purchase and adaptation of a densifier unit to operate with an existing resource recovery system, operating experience and modifications of the unit to adapt it to RDF, and actual manufacturing and burning of densified RDF in industrial waste fuel boilers and waste fuel gasifiers. The densified RDF was burned in tests at a pulp and paper company. Also, the RDF was densified for testing in three separate waste fuel gasifiers. Test reports for direct combustion and for gasification are included. (LEW)

12629 **(DOE/CS/20234—2) Energy recovery for Kent and Sussex Counties, Delaware: Phase II study report.** (Delaware State Solid Waste Authority, Dover (USA); Bechtel Civil and Minerals, Inc., San Francisco, CA (USA)). Dec 1982. Contract FG01-79CS20234. 93p. NTIS, PC A05/MF A01. Order Number DE83004751.

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The work reported is to evaluate two alternative resource recovery systems which would produce a fuel or an energy product (steam) for sale to an industrial plant. The first alternative is a refuse derived fuel (RDF) production facility which would process waste to produce fuel for sale to the plant. The RDF would be cofired with coal in new boilers. The second alternative is a mass burn steam generation facility which would produce high pressure superheated steam for sale. The steam would be used by the plant to cogenerate electricity and for the process. Conceptual designs are developed for each alternative to form the basis of estimates of capital and operating costs and potential energy revenues. Operating requirements are developed for both alternatives. An assessment is made of the impact of both alternatives on the environment, and it is concluded that the impact of either alternative will be negligible. Order of magnitude estimates are made of capital and operating costs. The relative sensitivity of estiamted tipping fee to variations in individual components is analyzed. Resource recovery is not found to be economically competitive with landfill disposal. (LEW)

12630 **(DOE/CS/20291—4) Development of the utilization of combustible gas produced in existing sanitary landfills: investigation of effects of air inclusion.** (Pacific Gas and Electric Co., San Francisco, CA (USA); Dynatech R/D Co., Cambridge, MA (USA)). Jan 1983. Contract FG01-79CS20291. 56p. NTIS, PC A04/MF A01. Order Number DE83005123.

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A combustible gas mixture composed of methane and carbon dioxide is generated in municipal solid waste landfills. A practical consequence of the collection of this fuel gas is the inclusion of some air in the collected product. The effects of such included nitrogen and oxygen on landfill gas operations are discussed. The effects include increased collection and purification costs, reduction in the quality of the fuel gas produced, corrosion, explosion hazards, and interference with odorant systems. The scope of such effects was determined using data and experience from the Mountain View, California, landfill gas recovery site as a basis. Useful supplemental fuel gas may be recovered despite the inclusion of air. Recommendations are given for establishing limits for nitrogen and oxygen content and minimizing the costs associated with their presence.

12631 **(DOE/CS/20544—1) Fundamental aspects of air classifier operation and design.** Vesilind, P.A.; Peirce, J.J. (Duke Univ., Durham, NC (USA)). Jan 1983. Contract AC05-79CS20544. 211p. NTIS, PC A10/MF A01. Order Number DE83004948.

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The study of the fundamental aspects of air classifier operation and design focused on: development of a descriptive model of air classification, development of a test for evaluating anticipated air classifier performance, effect of moisture on air classifier performance, effect of air classifier configuration, effect of feed composition, and effect of glass on the recovery of light fraction. Experiments were conducted using either a continuous or a batch air classifier. A direct correlation is found between the particle size distribution of glass in the light and heavy fractions and the air velocity in the classifier. Even with small particle sizes, the geometry of the particle is found to have a large effect on how the particle will react in the classifier. The presence of paper in the feed causes a small but definite increase in the quantity of glass in the light fraction at velocities of 1400 ft/min and less. (LEW)

12632 **(DOE/CS/24311—1) Urban waste as a potential energy source for brick plants.** (Denton, City of, TX (USA)). Dec 1982. Contract FG01-80CS24311. 37p. NTIS, PC A03/MF A01. Order Number DE83004750.

A project was formulated to address the technical feasibility of utilizing municipal solid waste (MSW) as a commercial fuel for the brick industry. Specifically, the refuse-derived fuels (RDF) from MSW is being investigated for three potential applications in the brick industry: (1) rotary brick kilns, (2) tunnel brick kilns, and (3) moisture dryers. The successful development of such a procedure would be a dramatic achievement with commercial merit for energy displacement. The sampling and collection of Denton, Texas MSW, the analysis of the MSW, the analysis of RDF and the potential utilization of RDF as an alternative source of fuel for the brick industry are described.

12633 **(DOE/CS/24317—2) Prototype tramp-metal separator: a summary of test results.** Bolczak, R. (National Center for Resource Recovery, Inc., Washington, DC (USA)). Nov 1982. Contract AC01-80CS24317. 44p. NTIS (US Sales Only). Order Number DE83003840.

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The test program on the prototype tramp metal separator (PTMS) consists of three stages. Typical municipal solid waste feedstocks that had undergone size reduction and trommeling were analyzed to determine their physical characteristics and to obtain samples of tramp metal. Tests were performed on individual particles to determine relevant aerodynamic properties. The PTMS was used to measure the deflections of selected particles and feedstocks dropped through the horizontal airstream. (LEW)

12634 **(DOE/CS/24456—2) State of California: resource-recovery profile.** (Opportunity Systems, Inc., Washington, DC (USA)). Jan 1983. Contract AC01-81CS24456. 206p. NTIS, PC A10/MF A01. Order Number DE83004949.

The municipal refuse-to-energy conversion projects in the State of California are identified and outlined. Technologies include: combustion systems, refuse-derived fuel systems, co-combustion, methane from landfill systems, and methane from wastewater systems. Also included is a brief legislative history and discussion of progress and problems relating to the waste-to-energy projects. (LEW)

12635 **(DOE/CS/30013—U13) Commercial utility rate guide for SOLCOST Data Bank cities.** Clayton, M. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Win 1982. Contract FG01-79CS30013. 638p. (UAH-RR—330). NTIS, PC A99/MF A01. Order Number DE83005499.

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This document gives the commercial rates for electricity and natural gas for each city included in the SOLCOST Data Bank. The data show company name, customer and minimum charges, demand charges, the fuel cost adjustment, taxes, surcharges, and the date for which the data is current. Rate structures for each company are shown as quoted by that company. The UAH utilizes the task team approach in obtaining, screening and formatting updated information as it is obtained from the utility companies, public service commissions, federal agencies, trade organizations and other sources. This team is continually identifying and acquiring new sources which will contribute to the currency of its data. Certain assumptions have been made and procedures established by the UAH in collecting the data. These assumptions and procedures have developed from problems arising from the complexities of collecting and formatting the data. Each utility company has a unique rate structure. For electricity, these range from straight-line (one price for each unit) to differing rates for winter and summer, time-of-day, hot water and space heating, on- and off-peak to life-line. In order to provide consistent data and to reduce its complexity and volume, the UAH reports costs for an assumed level of demand and usage. Also, taxing procedures vary widely from state to state and create much difficulty in accurately reflecting total cost. However, due to calculating procedures, the actual difference is minimal. The standard procedure devised by the UAH has been to calculate taxes on the total including surcharges. Calculations are shown for small and large commercial users.

12636 **(DOE/CS/30013—U16) Residential utility rate guide for SOLCOST data bank cities.** Lambert, S. (Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center). Sum 1982. Contract FG01-79CS30013. 640p. (UAH-RR—333). NTIS, PC A99/MF A01. Order Number DE83005409.

Portions of document are illegible. Printed copy available until stock is exhausted.

The document gives the residential rates for electricity and natural gas for each city in the SOLCOST Data Bank. It shows company name, customer and minimum charges, the fuel cost adjustment, taxes, surcharges, and the date which the data is current. Rate structures for each company are shown as quoted by that company. Computations have been made for each step showing the total without charges and taxes, the total with charges and taxes, the cost per kilowatt-hour or cubic foot, and the cost per million Btu with charges and taxes. The user must be aware of some unusually high costs-per-unit when considering rates for low consumptions. These rates can be misleading due to the addition of customer or additional charges. Certain assumptions have been made and procedures established by the University of Alabama Huntsville (UAH) in collecting the data. These assumptions and procedures have developed from problems arising from the complexities of collecting and formatting the data. Each utility company has a unique rate structure. For electricity, these range from straight-line (one price for each unit) to differing rates for winter and summer, time-of-day, hot water and space heating, on and off peak to life-line. In order to provide consistent data and to reduce its complexity and volume, the UAH reports costs for the basic rate of electricity. Generally, this is the rate for lighting, appliances, refrigeration, and cooking and water heating. Rates for natural gas are not as varied and complex.

12637 **(DOE/CS/30149—5) Co-utilization of municipal solid waste and wood residues for small-scale resource recovery: a preliminary assessment.** White, A.L.; Turner, A.; Geres, M.; Jacobs, G. (Northern Energy Corp., Boston, MA (USA)). Dec 1982. Contract AC02-80CS30149. 32p. NTIS, PC A03/MF A01. Order Number DE83004768.

The availability of municipal solid waste and wood residues in the Northeast region is assessed. General statements are supported by specific quantitative data gathered from published sources. Included are a number of observations with respect to the geographical interrelationships of the two resources. The technologies and equipment for converting each feedstock into usable energy and for combining the two in a co-utilization mode are discussed, emphasizing equipment appropriate to small scale applications. It is assumed that municipal solid waste technologies are more amenable to the additions of wood wastes than wood equipment is to municipal solid waste. Energy markets are examined for the major energy products from waste recovery - steam and electricity. A single idealized model of a typical market and its sources of feedstock is derived based on patterns of energy demand and resource availability. Case studies of two Vermont projects are presented. One is designed to use municipal solid waste as its primary feedstock, whereas the second seeks to use municipal solid waste as a supplement to industrial wood residue. (LEW)

12638 **(DOE/CS/40337—8) Load requirements for economical cogenerated energy facilities in Chicago. Energy Management Memorandum TM-82-8.** Porter, R.W. (Illinois Inst. of Tech., Chicago (USA). Dept. of Mechanical Engineering). Nov 1982. Contract FG02-80CS40337. 18p. NTIS, PC A02/MF A01. Order Number DE83005082.

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Based on the experience of previous feasibility case studies, the potential viability of a number of cogeneration and alternative fuel options in Chicago were assessed. The systems studied were regarded as central energy facilities that could serve a number of industries or institutions in the City. In the limit, a single user could be dealt within the context of the results as well. The eleven options considered included refuse, natural gas and low-sulphur coal fuels as used in various fired boilers, gas turbines and diesels. The range of available outputs analyzed were 42,400 - 616,000 lbm/h or 150-psig steam and 1.2 - 93.2 MW(e). Typical values of economic parameters representative of the City were employed as suggested

by the previous case studies. The situation of taxable ownership with 60% IDB (Industrial Development Bond) and 40% leveraged lease financing was used. In addition to providing for adequate costs of debt and lease service, a 15% discount on all cogenerated thermal and electrical energy was built into the venture. Because the users would not be providing equity capital for the proposed scheme this incentive is important in order to assure a significant benefit to candidate industries and institutions. While these and other assumptions may have to be modified in site-specific applications, the results are believed adequate for screening purposes and to indicate whether further study may be warranted or not. The basic economic analysis was a variation of the justifiable capital cost method. In the present case, the costs of equipment exclusive of distribution costs were known for the eleven options. Any balance available could be used for distribution. Estimates of distribution cost per unit length were used to generate maximum allowable distribution distances (if any) for each plant.

12639 **(DOE/CS/40337—9) Thermal-economic analysis of cogenerated energy recovery by mass-burning modular refuse incinerators. IIT Energy Management Report TR-82-2.** Chaudhary, Z.H.; Porter, R.W. (Illinois Inst. of Tech., Chicago (USA). Dept. of Mechanical Engineering). Dec 1982. Contract FG02-80CS40337. 69p. NTIS, PC A04/MF A01. Order Number DE83005081.

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The present work concerns the thermodynamic and economic analysis of the feasibility of installing and operating modular water-wall incinerators to burn municipal refuse for the purpose of cogeneration of steam and electricity. A general method of determining the heat balance for the class of systems of interest has been developed. A proposed facility to deliver steam to two industries in the City of Chicago has been chosen as a case study to illustrate the approach. A main objective of the analysis is to determine the economically optimum number of modular units (if any) based on the criterion of selecting the largest possible investment which achieves at least a minimum acceptable rate of return relative to all lesser investments. Both taxable and tax-exempt ownership options have been considered. In addition to equity financing, the effects of alternate financing schemes including debt and leveraged-lease financing have also been considered. The taxable cases with debt financing include both conventional and Industrial Development Bond, IDB, debt financing. The effect of displacing purchases as compared with sales to the electric utility has also been studied. The analysis includes appropriate treatment of the regulatory and tax provisions of the National Energy Acts and of the Economic Recovery Tax Act of 1981. It was found for the case study that viability and the economic choice of number of modular units is sensitive to the indirect cost rate and to the value of steam, but not very sensitive to the value of refuse disposal and electricity, or to the type of ownership and financing. For the present case, a 750 tons per day (680 tonnes per day) installation was found to be viable and optimum and would produce 131,000 lbm/h (59,420 kg/h) of psig (4408 kPa) steam and 3.76 MW(e) of electricity under rated conditions.

12640 **(DOE/NBM—2021934) Homeowners survey: gas utilities and the residential solar market.** Pilgrim, B.F. (Solar Energy Research Inst., Golden, CO (USA)). Apr 1982. Contract AC02-77CH00178. 76p. NTIS, PC A05/MF A01. Order Number DE82021934.

The market potential for a gas/solar energy market in the residential sector prompted the American Gas Association's Solar Energy Committee to analyze national homeowner data collected by Gallup for the Solar Energy Research Institute to see if it applies to gas-utility diversification. The survey results show that the public is interested in utility involvement. Key findings in the survey cover not only attitudes, but profile potential buyers, project market shares, and note regional-attitude differences. The utilities that diversify in this way could improve their relations with both customers and regulators as well as increasing their profits. 4 figures, 17 tables. (DCK)

12641 **(PB—83-107631) A model for optimal design of district heating networks.** Koskelainen, L. (Lappeenrannan Teknillinen Korkeakoulu (Finland)). 1978. 111p. NTIS, PC A06/MF A01.

A mathematical model is described for optimal design of district heating networks. The sum of the investment and operting costs is used as the optimization criterion. The model consists of three submodels. The simulation model may be used for solving the mass flow rates in pipes and pressure levels in nodal points. The stationary-state optimization model is needed for solving the pipe diameters. The dynamic optimization model is used for finding the optimal timing of the investments.

12642 **(OA-tr—2517) CHP: planning, technology, costs; the application of combined heat and power in a medium-sized city.** Wester, H.J. Translated from *Energie ;* **33**: No. 11, 358-366(Nov 1981). 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900468.

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A detailed account is given of a study for integrating new package combined heat and power (CHP) units into an existing district heating network in a medium-sized West German town. The system concept (gas turbine or combustion engine), the existing electricity and heat supply situation, environmental aspects, economics and risks are considered.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

12643 **(UCRL—88233-Rev.1) Analysis and comparison of automotive-propulsion systems.** Behrin, E. (Lawrence Livermore National Lab., CA (USA)). 1 Oct 1982. Contract W-7405-ENG-48. 11p. (CONF-830201—2-Rev.1). NTIS, PC A02/MF A01. Order Number DE83003878.

From Society of Automotive Engineers congress; Detroit, MI, USA (28 Feb 1983).

We analyze a number of existing and proposed automotive-propulsion systems and compare their specific energy and specific peak power in terms of mechanical energy delivered from the propulsion system's energy-conversion device. The calculations account for losses due to the energy-conversion process and include the masses of both the fuel (or energy-storage device) and the energy-conversion components. Values used in the comparisons range from the current state of the art, or most-probable forecasts of characteristics, to highly optimistic projections of device characteristics. On the basis of this analysis, we estimate the range and acceleration for passenger vehicles utilizing the various propulsion systems. We also examine power-boosted hybrid systems.

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 12655, 12655, 12656, 12657

12644 (CONF-801030—Vol.3, pp 1083-1089) **Problems in adapting ethanol fuels to the requirements of diesel engines.** Bandel, W. (Daimler-Benz AG, Stuttgart, Germany); Ventura, L.M. Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Progress is reported in a Brazilian research program to determine the adaptability of ethanol fuel to vehicular diesel engines, to assess the performance of additives used to improve the auto-ignition properties of ethanol, and to evaluate the effects of ethanol and the additives on the performance of the engine and its fuel injection system and on engine emissions. (LCL)

12645 **(DOE/ER/10065—3T) Plasma-jet ignition in a lean-burn CFR engine.** Tozzi, L.; Dabora, E.K. (Connecticut Univ., Storrs (USA). School of Engineering). Mar 1982. Contract AS05-79ER10065. 27p. (CONF-820801—15). NTIS, PC A03/MF A01. Order Number DE83005010.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

The parameters controlling plasma-jet ignition are explored in a lean-burn CFR engine. The effects of plasma energy and its duration, the plasma-cavity size and the plasma medium are investigaed. Premixed charge of methane air is used throughout. With the engine running at 800 RPM and at an equivalence ratio of 0.7, in-

creased plasma energy and reduced energy-deposition time result in improved performance. Tests with several sizes of plasma cavity reveal that for a given plasma energy and duration, an optimum size for best peformance can be determined. When the plasma medium is the fuel itself, it was found that both degradation and improvement could be obtained depending on the plasma-cavity size. For the range of designs used here, it was found that the best performance could be obtained when the plasma cavity is 150 mm^3 with the plasma medium being the same as the engine charge. In this case, a constant specific fuel consumption of 0.12 gm/Kw-s at equivalence ratios of 0.65 to 0.80 was obtained. Emissions data on CO, HC and NO/sub x/ show consistent trends and confirm the superiority of the 150 mm^3 plasma unit.

12646 (DOE/ET/15397—T5) Application of numerical-simulation methodology to automotive combustion. Technical progress report. (Science Applications, Inc., La Jolla, CA (USA)). Sep 1982. Contract AC04-79ET15397. 92p. NTIS (US Sales Only). Order Number DE83003302.

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Progress is reported for a program whose goal is to develop, validate, demonstrate and apply a numerical simulation technique for in-cylinder reactive flows in internal combustion engines. Previous work on the project involved the continued development and validation of a finite difference based simulation model (MAGIC) for time-dependent axisymmetric flows which includes: a generalized coordinate system for arbitrary mesh design and treatment of complex and time-dependent boundaries; multiple and interacting chemical species; coupled swirl velocity component; and two-equation turbulence closure. The program phase reported here, involved the final development and validation of the fuel injection/droplet evolution model; the completion of a valve model which accounts for intake and exhaust flow processes; development of the heat transfer prediction capability with the initiation of engine heat transfer studies; continuation of numerical development studies related to swirling flow and reactive turbulence modeling; and the initiation of induction stroke simulation studies. Finally, the model has been validated and exercised for parametric studies of fuel/air mixing resulting from liquid fuel injection and the study of hydrocarbon quench layer evolution under realistic engine conditions. These two demonstration studies are discussed.

12647 (UCRL—88233) Analysis and comparison of automotive-propulsion systems. Behrin, E. (Lawrence Livermore National Lab., CA (USA)). 1 Oct 1982. Contract W-7405-ENG-48. 24p. (CONF-830201—2). NTIS, PC A02/MF A01. Order Number DE83004306.

From Society of Automotive Engineers congress; Detroit, MI, USA (28 Feb 1983).

A number of existing and proposed automotive-propulsion systems are analyzed and their specific energy and specific peak power in terms of mechanical energy delivered from the propulsion systems' energy-conversion device are compared. The calculations account for losses due to the energy-conversion process and include the masses of both the fuel (or energy-storage device) and the energy-conversion components. Values used in the comparisons range from the current state of the art, or most-probable forecasts of characteristics, to highly optimistic projections of device characteristics. On the basis of this analysis, the range and acceleration for passenger vehicles utilizing the various propulsion systems is estimated. The power-boosted hybrid systems are also examined.

3302 External Combustion Engines

12648 (ORNL/TM—8524) Two-phase, two-component Stirling engine with controlled evaporation. West, C.D. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 19p. NTIS, PC A02/MF A01. Order Number DE83005172.

In a Stirling-like engine, the specific power can be greatly increased by the use of a two-component, two-phase working fluid. Theory and experiments have indicated that a two- to threefold increase is easily attainable. This report shows that by controlling the rate at which the liquid is evaporated into the expansion cylinder, still larger increases may be achieved under quite reasonable operating conditions. Successful application of this principle would make it practicable to operate engines with moderate hot-end temperatures and perhaps even with the very low temperatures available from simple nontracking solar collectors.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 12459, 12647

12649 (CONF-8009170—5) EPRI/TVA pilot electric-vehicle demonstration: update 1980. Ferraro, R.J.; Barnett, J.H.; Furman, C.R. (Electric Power Research Inst., Palo Alto, CA (USA); Tennessee Valley Authority, Chattanooga (USA)). 1980. 29p. American Public Power Association, 2600 Virginia Ave. NW, Washington, DC.

From American Public Power Association energy management and communications workshop; Myrtle Beach, SC, USA (30 Sep 1980).

Portions of document are illegible.

Although widespread use of eV's has significant potential for favorable impacts on utility load curves, many questions regarding eV's and eV subsystem characteristics remain unanswered. To focus on those aspects of eV's of most importance to the energy supplier-the nation's electric utilities-EPRI is participating with the Tennessee Valley Authority (TVA) in the research, development and demonstration of EV's. Initiated in 1978, the EPRI-sponsored two-year pilot EV demonstration at TVA was designed to identify utility impact areas by demonstrating reliable electric vehicles in well-defined and controlled modes of use. Key data is being acquired on all aspects of EV performance, reliability, operations, network interaction, and subsystems. This paper discusses the EPRI/TVA EV demonstration program progress to date. Described are the planning and implementation phase, and the data acquisition system hardware.

12650 (DOE/CS/50045—T1) Consumer acceptance of electric vehicles. Sethna, B.N. (Clarkson Coll. of Tech., Potsdam, NY (USA)). 2 Sep 1982. Contract FG01-79CS50045. 88p. NTIS, PC A05/MF A01. Order Number DE82021175.

Portions of document are illegible.

The main objective of this study was to determine guidelines for the enhancement of consumers' perceptions to electric vehicles (EV). The specific objectives were to: expose the population of Potsdam, New York to an electric car, and to demonstrate its functioning; determine the relative importance of the different attributes of the electric car from the viewpoint of the potential consumer; and determine changes in consumers' perceptions after exposure to the car (and accompanying media coverage), as compared with their perceptions before exposure. An electric vehicle was ordered from a Florida firm whose officers absconded taking the vehicle downpayment and not delivering the EV. Subsequently the chief investigator of this project drove a rented EV for 5 months with survey respondents as passengers. The conclusions and recommendations of the study were: exposure to the EV and advertising positively affect its public acceptance; the high price is the most negative feature; energy tax credits would promote EV sales; and the most probable current use for EV's is in utility service fleets. (LCL)

12651 (SAND—82-7092C) Design of bipolar, flowing-electrolyte zinc-bromine electric-vehicle-battery systems. Malachesky, P.A.; Bellows, R.J.; Einstein, H.E.; Grimes, P.G.; Newby, K.; Young, A. (Exxon Research and Engineering Co., Linden, NJ (USA)). 1983. Contract AC04-76DP00789. 16p. (CONF-830201—1-DRAFT). NTIS, PC A02/MF A01. Order Number DE83002513.

From Society of Automotive Engineers congress; Detroit, MI, USA (28 Feb 1983).

The integration of bipolar, flowing electrolyte zinc-bromine technology into a viable electric vehicle battery system requires careful analysis of the requirements placed on the battery system by the EV power train. In addition to the basic requirements of an appropriate battery voltage and power density, overall battery system energy efficiency must also be considered and parasitic losses from auxiliaries such as pumps and shunt current protection minimized.

An analysis of the influence of these various factors on zinc-bromine EV battery system design has been carried out for two types of EV propulsion systems. The first of these is a nominal 100V dc system, while the second is a high voltage (200V dc) system as might be used with an advanced design ac propulsion system. Battery performance was calculated using an experimentally determined relationship which expresses battery voltage as a function of current density and state-of-charge. Based on these studies, low profile, 12 dm^2 bipolar cell components have been developed which are readily incorporated into a variety of motive power and stationary energy storage system designs.

3304 Hybrid Systems

REFER ALSO TO CITATION(S) 12647

3305 Flywheel Propulsion

REFER ALSO TO CITATION(S) 12647

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 11969, 11983, 12040, 12644, 12647

12652 (CONF-801030—Vol.3, pp 935-944) **International outlook of Otto versus diesel cycle engine for operation on biomass fuels.** Pischinger, F.F. (Aachen Technical Univ., West Germany). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

The adaptation of diesel engines to alcohol fuels requires special measures to be applied to fuels (e.g. ignition accelerators) or the engine (ignition aids). An improvement in performance is thereby possible; however, the thermal efficiency level remains about the same as with diesel oil. Prechamber diesel engines used for passenger cars and converted to alcohol operation can, at the most, offer improved part-load efficiencies as compared with an optimized alcohol Otto engine. The average fuel consumption for both engines is about equal. For the direct-injection diesel engine, used in commercial vehicles, there remains an advantage in view of consumption over the Otto engine. The direct-injected diesel engine remains the most economic powerplant for commercial vehicles. This is particularly valid when the advantages of turbocharging are fully exploited. In addition, modified diesel engines will be best suited for the use of a broad variety of fuels including vegetable oils. Both engine types achieve lower exhaust pollutant levels when using alcohol fuels as compared to when using oil-derived fuels.

12653 (CONF-801030—Vol.3, pp 1005-1010) **Engine study of efficiency and fuel consumption with ethanol fuel.** Brinkman, N.D. (Research Labs., Warren, MI). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Pure ethanol is used as a spark ignition engine fuel in Brazil, and some have considered its use in the United States. To provide needed engine efficiency data with ethanol, a single-cylinder engine was operated at compression ratios ranging from 7.5 to 18 and at equivalence ratios from 1.2 (rich) to the lean limit. Results were compared to those obtained with gasoline at 7.5 compression ratio, the nominal value for Brazilian gasoline-fueled engines. When compared at the same compression ratio and equivalence ratio, engine thermal efficiency with ethanol was about 3 percent greater than that with gasoline. Increasing compression ratio from 7.5 to 18 increased the efficiency of the ethanol-fueled engine by about 18 percent. Mass specific fuel consumption was greater with ethanol than with gasoline due to ethanol's low heating value. At equivalent engine conditions, ethanol fuel consumption was 57 percent greater than that with gasoline. However, the ethanol engine operating at the lean limit at 18 compression ratio consumed only 5 percent more fuel than that of the gasoline engine operating at 1.2 equivalence ratio and 7.5 compression ratio.

12654 (CONF-801030—Vol.3, pp 1075-1082) **Use of glow-plugs in order to obtain multifuel capability of diesel engines.** Nanni, H.; Domschke, A.G.; Brunetti, F.; Rozov, V.; Rosa, F.; de O. Borba, M.L.; de Abreu, R.S. (Instituto Maua de Tecnologia, Sao Caetano do Sul, Brazil). Jan 1981. NTIS, PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

The findings of research work on adaptation of diesel for operation with alternative fuels, particularly methanol are presented. Single-cylinder and four-cylinder engines were tested, without any modification except for the placing of glow plugs in the combustion chambers, in order to ignite the fuel. The performance tests with methanol showed brake efficiencies significantly higher than those obtained with diesel oil. Endurance testing was done using a commercially available glow plug in a single-cylinder engine, and the targeted 1000 hours of operation were attained without difficulty.

12655 (DOE/R5/10316—T1) **Alternative engine fuels: educational demonstration project. Final report.** True, J.A. (Minnesota Univ., St. Paul (USA). Dept. of Agricultural Engineering). 15 Dec 1982. Contract FG02-81R510316. 9p. NTIS, PC A02/MF A01. Order Number DE83004579.

The purpose of the project was to produce four educational tools: two portable engine demonstration trailers that show the operational characteristics of a spark ignition engine and a diesel engine burning various alternative fuels; a 16 mm movie of the several engine fuel demonstrations for use in physical situations where the actual demonstrations cannot be given; Agricultural Extension Service bulletins describing the operation of engines on alternative fuels; and construction plans and procedures for use by others in assembling similar demonstrations. The 2 trailers, one with a spark-ignition engine-generator set, one with a diesel engine-generator set, were built and demonstrated at 9 farm meetings with about 1500 people attending. A single 12-minute 16 mm film on the use of ethanol and sunflower oil as alternate fuels was produced and is available for public use. A paper titled Alternative Engine Fuels Demonstration and Materials Test was presented at a meeting of Agricultural Engineers and is available. (LCL)

12656 (TENRAC/EDF—070-Pt.1) **Cottonseed oil as a diesel-engine fuel. Final report.** Staph, H.E.; Staudt, J.J. (Southwest Research Inst., San Antonio, TX (USA)). 31 Jul 1982. 97p. NTIS, PC A05/MF A01. Order Number DE83900881.

If diesel fuel becomes unavailable for any reason, can diesel powered farm equipment function on alternate fuels from energy crops that are available on the farm. This project sought to gain some insight into this question through the use of once-refined cottonseed oil as fuel in a typical unmodified agricultural diesel engine. The engine used for test was an International Harvester Model DT-436B 6 cylinder, inline, direct injection, turbocharged engine of approximately 175 brake horsepower at 2500 rpm. The engine was run on a stationary stand using blends of reference diesel fuel (DF-2), once-refined cottonseed oil (CSO), and transesterified cottonseed oil (ESCO). The latter is cottonseed oil which has been processed to give a methyl ester instead of a glyceride. The volume percent blends of fuels used in the tests ranged from 100% DF-2, to 20/80 DF-2/CSO, 50/50 DF-2/ESCO, 50/50 CSO/ESCO, and 100% ESCO. The test procedures and results are presented in this volume. The results suggest that ESCO would probably be a satisfactory substitute for diesel fuel, but more testing is required. None of the fuels tested is a cost effective alternative to diesel fuels. ESCO presently costs four to five times as much as commercial diesel fuel.

12657 (TENRAC/EDF—070-Pt.2) **Cottonseed oil as a diesel-engine fuel. Part 2. Appendices. Final report.** Staph, H.E.; Staudt, J.J. (Southwest Research Inst., San Antonio, TX (USA)). 31 Jul 1982. 436p. NTIS, PC A19/MF A01. Order Number DE83900880.

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This appendix, Volume 2 of a 2 volume report, contains the original data and the methods used to reduce the data obtained in

performance tests on diesel engines fueled by diesel fuel, cottonseed oil, and mixtures of these fuels. (LCL)

36 MATERIALS

REFER ALSO TO CITATION(S) 11653, 13535

12658 **(NP—3900855) Department of Metallurgy and Materials research report, 1981-82.** (Birmingham Univ. (UK). Dept. of Metallurgy and Materials). 1982. 81p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83900855.

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Summaries are presented, in the form of objectives and present positions, of research in the areas of alloy chemistry; casting solidification and welding; metal markets; diffraction contrast, microanalysis, and scanning and transmission electron microscopy; electrometallurgy; electronic materials; fracture, heat treatment; machining; metal forming; microstructure and properties; polymers; powder metallurgy; radiation damage; and surface studies. (DLC)

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 11583, 11647, 11651, 11949, 11950, 12294, 12294, 12370, 12458, 12760, 12878, 13404

12659 **(BNL—30030) Effects of ternary additions on Young's modulus and the martensitic transformation of Nb_3Sn.** Bussiere, J.F.; Faucher, B.; Snead, C.L. Jr; Suenaga, M. (Institut de Genie des Materiaux, Montreal, Quebec (Canada); Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 13p. (CONF-810835—30). NTIS (US Sales Only). Order Number DE81031968.

From 1981 cryogenic engineering conference; San Diego, CA, USA (10 Aug 1981).

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Softening of Young's modulus and the occurence of the martensitic transformation were found to be strongly affected by the presence of relatively small amounts (0 to 4 at, %) of Ta, Ti or Zr with the largest effects occurring for Ti. Additions incorporating 2 at. % Ti in the Nb_3Sn causes Young's modulus to increase by a factor 2 at 10K and the transformation to be suppressed. Since Young's modulus also increases rapidly with strain, further measurements will be required to determine to what extent the stress state of Nb_3Sn incorporated in a bronze matrix is affected by ternary additions. 3 figures.

12660 **(CONF-811150—10-Draft) Theoretical relationships between creep and swelling by point defect absorption during irradiation.** Mansur, L.K.; Coghlan, W.A. (Oak Ridge National Lab., TN (USA)). Nov 1981. Contract W-7405-ENG-26. 7p. NTIS, PC A02/MF A01. Order Number DE83003504.

From Yamada conference on point defects and defect interactions in metals; Kyoto, Japan (16 Nov 1981).

Relationships between irradiation creep and swelling implicit in the theories of these processes are derived. Four mechanisms of irradiation creep are treated. These are the climb-only process of preferred point defect absorption on dislocations; the climb and glide processes resulting from cumulative absorption of defects at dislocations, i.e., preferred absorption glide and swelling-driven creep; and the recently developed climb and glide process enabled by point defect concentration fluctuations resulting from cascades. The results are expressed both as differential equations for creep rate in terms of swelling rate and as integrated forms giving creep strain in terms of swelling for stabilized microstructures.

12661 **(CONF-820628—18) Hardening of irradiated alloys due to the simultaneous formation of vacancy and interstitial loops.** Ghoniem, N.M.; Alhajji, J.; Garner, F.A. (California Univ., Los Angeles (USA); Westinghouse Hanford Co., Richland, WA (USA)). 1982. Contract AS08-81DP40158. 16p. NTIS, PC A02/MF A01. Order Number DE83004887.

From 11. international symposium on effects of radiation on materials, American Society for Testing and Materials; Scottsdale, AZ, USA (28 Jun 1982).

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A model is presented for the simultaneous nucleation and growth of vacancy and interstitial loops in irradiated metals. The model is based on the homogeneous time-dependent rate theory. Conservation equations are developed for single defects as well as defect clusters. Defect-conservation equations include production by irradiation and thermal sources; and destruction by mutual recombination, migration to sinks as well as clustering into loops. Interstitial clustering is assumed to occur by diffusion of interstitial atoms. Vacancy loops, on the other hand, are assumed to form by an athermal cascade-collapse process. The density of such loops is determined as a result of the production of cascades and the finite loop lifetime. Cascade overlap and coalescence are also included in the model. The calculations are extended to the analysis of the radiation-induced changes in tensile properties due to formation of interstitial and vacancy loops. A simpe hardening model relates the microstructural calculations to predictions of changes in tensile strength. The results of this study show good agreement with hardening data for copper irradiated in RTNS-II at room temperature. The results also provide insight on differences in microstructural results observed in various experimental studies on copper. 7 figures.

12662 **(DESY-SR—82-02) Double excitation structure in the L-edge X-ray absorption spectra of α-cerium.** Lengeler, B.; Mueller, J.E.; Materlik, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750938.

The L absorption spectra of γ- and α-Ce have been measured. The L_2 and L_3 spectra of both systems show white lines, but α-Ce exhibits an additional peak 9 eV above the white line. The white line and the EXAFS of α-Ce are correctly described by the single particle picture. We deduce that α-Ce is not valence fluctuating, and that it has the same valence (3^+) as γ-Ce. We suggest that the α-peak arises from a process in which the 2p and the 4f electrons are simultaneously excited into empty 5d states.

12663 **(DOE/CS/40310—T1) Continuous production of strip by Rheocasting. Final report, August 16, 1978-September 30, 1981.** Flemings, M.C. (Massachusetts Inst. of Tech., Cambridge (USA). Materials Processing Center). 1981. Contract AT01-76CS40310. 35p. NTIS, PC A03/MF A01. Order Number DE82019281.

The report presents results of the mathematical and experimental modeling study undertaken, and also (1) describes the basic mechanism and process of Rheocasting (shaping in semisolid state), (2) outlines work done to date, and (3) attempts to delineate areas of potential engineering applications of the process. Two such areas appear most fruitful for further work. One is that of forming shapes, where processes such as die casting or forging are used today. Pilot projects in industry indicate this process is well advanced for the nonferrous alloys of aluminum and magnesium, but important potential applications also exist for copper, gray iron, and steel. The second is in continuous casting, especially of strip. Significant technical and economic advantages could result from Rheocasting strip of aluminum, magnesium, and steel alloys. Potential technical advantages include improved surface, greater freedom from cracking and segregation, ability to strip cast alloys not now castable, and increased productivity.

12664 **(DOE/ER/02172—39) Inelastic deformation and phenomenological modeling of aluminum including transient effect.** Cho, C.W. (Cornell Univ., Ithaca, NY (USA). Materials Science Center). 1980. Contract AC02-76ER02172. 249p. NTIS (US Sales Only). Order Number DE83004495.

Mf only; illegibility does not permit PC reproduction. Thesis.

A review was made of several phenomenological theories which have recently been proposed to describe the inelastic deformation of crystalline solids. Hart's deformation theory has many advantages, but there are disagreements with experimental deformation at stress levels below yield. A new inelastic deformation theory was proposed, introducing the concept of microplasticity. The new

model consists of five deformation elements: a friction element representing a deformation element controlled by dislocation glide, a nonrecoverable plastic element representing the dislocation leakage rate over the strong dislocation barriers, a microplastic element representing the dislocation leakage rate over the weak barriers, a short range anelastic spring element representing the recoverable anelastic strain stored by piled-up dislocations against the weak barriers, and a long range anelastic spring element representing the recoverable strain stored by piled-up dislocations against the strong barriers. Load relaxation and tensile testing in the plastic range were used to determine the material parameters for the plastic friction elements. The short range and long range anelastic moduli and the material parameters for the kinetics of microplasticity were determined by the measurement of anelastic loops and by performing load relaxation tests in the microplastic region. Experimental results were compared with a computer simulation of the transient deformation behavior of commercial purity aluminum. An attempt was made to correlate the material parameters and the microstructure from TEM. Stability of material parameters during inelastic deformation was discussed and effect of metallurgical variables was examined experimentally. 71 figures, 5 tables.

12665 **(DOE/ER/10428—4) Protective oxide films. Progress report.** MacCrone, R.K.; Shatynski, S.R. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). 1982. Contract AC02-79ER10428. 14p. NTIS, PC A02/MF A01. Order Number DE83004682.

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The factors affecting the incorporation of metallic Ni particles in NiO scale are being investigated. Chemical diffusivity and defect concentrations were calculated from Wagner's theory of oxide growth, for oxidation of W at 750, 850, and 950°C and 0.01, 0.1, and 1 atm oxygen pressures. Preliminary analysis of the EPR spectrum of TiO_2 scale is reported. Raman spectroscopy is being utilized to study the oxide phases in scales. 3 figures.

12666 **(DOE/ER/10428—T3) Examination of the growth of NiO on Ni using magnetic-resonance techniques.** Leatherman, G.L.; quinn, D.; MacCrone, R.K.; Shatynski, S.R. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering). 1979. Contract AC02-79ER10428. 7p. NTIS, PC A02/MF A01. Order Number DE83004814.

Films of NiO were thermally grown on Ni substrates at 900°C in a variety of oxygen partial pressures varying from 0.01 to 1 atm. The oxides were removed from the substrate and examined using magnetic resonance. These experiments detected particles of Ni embedded in the NiO. These results are compared with consequences expected of a classical parabolic bulk diffusion model. The severe deviations from the expected consequencies of simple models have resulted in a proposal oxidation model based upon oxygen diffusion down grain boundaries.

12667 **(DOE/ER/10740—8) X-ray topographic fractography of single crystals of molybdenum and niobium.** Hmelo, A.B. (State Univ. of New York, Stony Brook (USA). Dept. of Materials Science and Engineering). Dec 1982. Contract AC02-80ER10740. 150p. NTIS, PC A07/MF A01. Order Number DE83005066.

Thesis.

The semi-brittle (001) cleavage fracture at 77°K of Mo and outgassed Nb single crystals was related to their fracture toughness. Berg-Barrett x-ray reflection topography and White Beam Synchrotron Fractography were used. Calibrated electropolishing in layers followed by Synchrotron Fractography revealed that under the conditions which existed at the tip of the running crack, Mo underwent general yielding which resulted in a plastically curved lattice. This result correlates with the substantial fracture toughness for Mo measured previously. On the other hand, double [112] slip was observed for Nb. The plastic zone associated with the crack-tip is shown to have a structure typicla of shock-loaded materials, consisting of arrays of screw dislocations, micro- and macrotwins. This result correlates with the low fracture toughness of Nb at 77°K. It is proposed that these extremes in cleavage behavior for Mo vs Nb can be rationalized in terms of the capacity of a bcc structure to undergo a slip to twinning transition at high strain rates. 32 figures, 5 tables.

12668 **(DOE/ET/29354—3) Materials research for hydrogen-cooled superconducting power-transmission lines (SPTL). Part I. Liquid hydrogen as a dielectric. Part II. Superconducting materials. Annual report, January 1, 1981-December 31, 1981.** Sletten, A.M.; Rosado, M.; Braginski, A.I. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 24 Feb 1982. Contract AC02-79ET29354. 127p. NTIS, PC A07/MF A01. Order Number DE83004801.

In Part I of this program a system for electric breakdown and dielectric loss measurement in liquid H_2 was designed and constructed. In Part II it was shown experimentally that Nb_3Ge superconductor can be fabricated with electrical and mechanical properties suitable for use in LH_2-cooled SPTL's.

12669 **(DP-MS—82-21) Heat treating effects on environmental hydrogen embrittlement of nickel.** Caskey, G.R. Jr.; McCabe. L.P. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 34p. (CONF-821049—9). NTIS, PC A03/MF A01. Order Number DE83004921.

From TMS/AIME fall meeting; St. Louis, MO, USA (24 Oct 1982).

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Environmental hydrogen embrittlement to Nickel 200, Duranickel 301 (registered trademark of International Nickel Company, Inc.), and Beryllium Nickel was evaluated by measuring fracture strain of smooth and notched tensile specimens in high-pressure hydrogen. Hydrogen damage was comparable in all three alloys when in the annealed condition, although absolute values of ductility differed. Aging of Duranickel 301 increased susceptibility to hydrogen damage. In contrast, neither graphitization of Nickel 200 nor aging of Beryllium Nickel to maximum hardness had much effect on hydrogen damage. Differences in hydrogen damage are attributed to the differing nature of the precipitate phases in each alloy. 9 figures, 4 tables.

12670 **(EGG-M—15682) Ultrasonic detection of molten/solid interfaces of weld pools.** Lott, L.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 2p. (CONF-8210104—2). NTIS, PC A02/MF A01. Order Number DE83003243.

From Quality testing manufacturing (QUALTEST I) conference; Pittsburgh, PA, USA (4 Oct 1982).

Results of the study indicate that it is possible to detect molten weld-pool interfaces and obtain information about their size and location using ultrasonic techniques. The study has also identified problems which must be solved before the technique can be used for weld process control: (1) making a positive identification of reflected ultrasonic signals, i.e., distinguishing between signals reflected from the molten/solid interface or from solid/air surfaces in the vicinity of the weld pool, and from grain boundaries in the heat-affected-zone; and (2) determining the effect of temperature gradients near the molten zone on the propagation of ultrasonic waves which affects the ability to accurately measure weld-pool interface location.

12671 (INIS-SU—125, pp 268) **Radio-frequency resonance effect on diffraction of Moessbauer gamma quanta in a crystal.** Dzyublik, A.Ya. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

12672 (INIS-SU—125, pp 517) **Studying the phase composition of surface zones in white layers obtained during steel frictional-strengthening treatment.** Kal'ner, V.D.; Zhuravleva, N.A.; Rejman, S.I.; Mitina, G.A.; Shpinel', V.S. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

12673 **(IS-RIC-PR—3) Critical evaluation of binary-rare-earth phase diagrams. Progress report, March 1, 1982-May 31, 1982.** Gschneidner, K.A. Jr.; Calderwood, F.W. (Iowa State Univ. of Science and Technology, Ames (USA). Rare-Earth Information Center). Jun 1982. Contract W-7405-ENG-82. 139p. NTIS, PC A07/MF A01. Order Number DE83003815.

This report is a continuation of the first two quarterly reports IS-RIC-PR-1 (December 1981) and IS-RIC-PR-2 (March 1982). Occasionally reference is made to data quoted in the earlier reports, and the reader should refer to these reports for this information. Various binary rare earth alloys are discussed.

12674 **(IS-T—912) Formation of helium-gas bubbles in the vanadium-titanium binary and ternary alloys irradiated by energetic Ni^{++} ions.** Schneider, J.G. (Ames Lab., IA (USA)). 1980. Contract W-7405-ENG-82. 44p. NTIS, PC A03/MF A01. Order Number DE83004938.

Thesis.

The alloys were three V-Ti binary alloys with Ti up to 21.0 at%, six V-Ti-Be ternary alloys and six V-Ti-Zr ternary alloys with Be and Zr up to 1.0 at.%. The alloys were preimplanted with helium to 80 appM, followed by Ni^{2+} ion irradiation to a damage dose of 25 dpa at 700°C. TEM revealed the production of helium gas bubbles in all alloys. Neither the primary solute Ti nor the secondary solutes Be and Zr affected the bubble formation except the distribution mode. Two modes of distribution were observed: relatively uniform in mode I and highly nonuniform in mode II. The particular distribution mode that predominated in a given alloy depended upon whether or not the matrix of the alloy was free of inclusion particles and second phase precipitates. The distribution in the V-5% Ti alloy was strictly in mode I because the alloy was relatively free of oxides, whereas in the other two binary alloys with higher Ti contents, thus containing more TiO inclusions, the mode varied from I to II in different regions. In all ternary alloys, especially those containing Zr, the distribution mode was predominantly II. The Ni^{2+} ion irradiations induced needle-like precipitates V_2Zr intermetallic with a preferential orientation in the <001> directions in the V-Ti-Zr alloys. The shape of bubbles was spherical in the as-irradiated state, but became cuboidal after a post-irradiation anneal at 1050°C for 100 h.

12675 **(IS-T—993) Moessbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces.** Lin, M.C. (Ames Lab., IA (USA)). Jan 1982. Contract W-7405-ENG-82. 101p. NTIS, PC A06/MF A01. Order Number DE83004980.

Thesis.

Moessbauer effect spectroscopy was used to measure the temperature dependence of the ^{57}Fe effective magnetic hyperfine field H/sub eff/ and isomer shift δ of Fe_3Al/sub x/Si/sub 1-x/ ($0 \leqq x \leqq 1$) from 77K to the Curie temperature. The observed dependence of H/sub eff/ and δ on Al concentration can be qualitatively understood in terms of the calculated band structure of Fe_3Si. ^{57}Fe Moessbauer spectra was also obtained at liquid nitrogen and room temperatures for metallic glasses $Fe^{82}B$/sub 18-x/Be/sub x/ with $0 \leqq x \leqq 6$. Width of the probability distribution function of the effective magnetic hyperfine field remains constant at 80 kOe. However, the effective magnetic hyperfine field at 77°K initially increases with Be content, but starts to decrease as x exceeds four. The isomer shift is -0.032 mm/s for samples with $x \leqq 4$ but changes to -0.050 mm/s for samples with $x > 4$. The crystallization products obtained upon annealing the samples were identified. Moessbauer spectroscopy and electrochemical measurements were used to study effects of chloride ions on a passivated iron surface in boric acid-sodium borate buffer solution at pH 8.4. The Moessbauer spectrum of the oxide film formed after breakdown of the passive film by aggressive chloride ions consists of a doublet with linewidth of 0.51 +- 0.03 mm/s, isomer shift of 0.35 +- 0.02 mm/s relative to the metallic iron, and quadrupole splitting of 0.79 +- 0.01 mm/s. The quadrupole splitting differs from that of the passive film which has line-widths of 0.55 +- 0.08 mm/s, an isomer shift of 0.36 +- 0.01 mm/s, and a quadrupole splitting of 0.94 +- 0.06 mm/s.

12676 **(IS-T—1000) Hydrogen and deuterium diffusion in vanadium alloys.** Herro, H.M. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 58p. NTIS, PC A04/MF A01. Order Number DE83004964.

Thesis. Submitted to Iowa State Univ., Ames.

H and D diffusion coefficients were measured between 473 and 230°K in alloys of vanadium containing Ti or Nb, using Boltzmann-Matano techniques. Both H and D diffusion decreased with H isotope concentration in all alloys at all temperatures. Effect of Niobium additions was to reduce the rate of H migration to a minimum in the 75 at. % Nb alloy. The rate of H migration decreased with Ti up to 30 at % Ti. The diffusion coefficients exhibited an Arrhenius temperature dependence and the resulting diffusion activation energy and D_0 values both increased with Ti and with Nb to a miximum of 75 at % Nb. D diffusion activation energies were larger than corresponding H values in all alloys. The diffusion behavior found in these alloys is not well represented by current local deep trapping models. 12 figures, 6 tables.

12677 **(IS-T—1026) Effect of stress on the transformation in nickel-titanium.** Hsu, C.H. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 140p. NTIS, PC A07/MF A01. Order Number DE83004855.

Thesis.

The shape memory phase transformation in Ni-Ti was studied using tubes and wires of near equiatomic composition. For both Ni-Ti tubes and wires, the axial transformation strain increases with increasing applied tensile stress. This increase is interpreted in terms of the effect of the applied stress to establish preferred directions of transformation shear during transformation to the low temperature phase. Upon the reverse transformation on heating, the strains are reversed. Other effects of the applied tensile stress are to increase the martensite start (M/sub S/) and austenite start (A/sub S/) temperatures and to increase the resistivity of the low temperature phase. The relative transformation volume change on cooling was 0.19 or 0.22%, according to hydrostatic weighing or strain gage. Earlier lattice parameter measurements of the high temperature B2 phase and low temperature distorted B19 phase indicate about -0.5%, a volume decrease. Several possible explanations for the discrepancy are discussed. Prior high-level TFC transformation-fatigue cycling) into the millions of cycles causes a decrease in the applied stress dependence of the total transformation strain, M/sub S/ and A/sub S/, and the low temperature phase resistivity. Tensile tests were conducted or uncycled and TFC'd wires, mostly in the high temperature phase. Prior TFC was found to cause an increase in yield stress and a decrease in fracture strain and is considered to be similar to prior cold working. Annealing at 400°C produces partial restoration of the transformation and tensile properties; annealing at 600°C produces full restoration.

12678 **(IS-T—1027) Electronic structure of hcp lutetium.** Tibbetts, T.A. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 78p. NTIS, PC A05/MF A01. Order Number DE83004866.

Thesis.

The electronic structure of hcp lutetium was calculated by means of the Linearized Augmented Plane Wave-including Spin-Orbit coupling (SO-LAPW) band structure method, providing a fully relativistic self-consistent prototypical paramagnetic heavy rare earth Fermi surface. The calculated band structure, density of states, Fermi surface, susceptibility, and magnetic form factor are presented and compared with the results of dHvA, specific heat, susceptibility, and induced neutron magnetic form factor experiments. Good agreement is found between experiment and theory, although instability of the 4f-band position remains a problem. Additionally, it is felt that improvements in the exchange-correlation potential and in the Muffin-Tin potential approximation will improve the convergence of the method and the quality of the results.

12679 **(IS-T—1028) Study of the electrowinning of copper using a fluidized-bed electrochemical reactor.** Felker, D.L. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 141p. NTIS, PC A07/MF A01. Order Number DE83004854.

Portions of document are illegible. Thesis.

A study was done on the use of a fluidized bed electrochemical reactor for the recovery of copper from aqueous solutions. Electrolyte solutions containing 0 to 8 g/l copper, 0 to 8 g/l iron and 200 g/l sulfuric acid were used. Porous diaphragms were used to separate the cathode and anode regions. The current efficiency, energy consumption rate and volumetric reaction rate were calculated for the experimental conditions. When the catholyte and anolyte are circulated from a common reservoir and iron(II) is present in the electrolyte, the energy consumption rate exhibits a minimum value of about 1.5 kWh/lb a volumetric reaction rate (VRR) of about 100 lb Cu/m^3 h. When the anolyte and catholyte are separated, the energy consumption rate rises linearly with VRR, being about 1 kWh/lb Cu at 100 lb Cu/m^3 h (this is roughly 2x the VRR of a conventional electrowinning cell). The optimum bed width in the direction of current flow was about 2 cm. A mathematical model which takes into account the dissolution of copper by ferric ion and oxygen is shown to explain the changes in the current efficiency and the VRR with current density seen in most of the experiments. Results indicate that separation of the catholyte and anolyte is imperative. Experiments showed that this can be accomplished using a porous Vycor glass diaphragm, which also eliminated the problem with copper dendrites growing through the diaphragm.

12680 **(IS-T—1037) Photoemission study of the 4f character in gamma- and alpha-cerium.** Wieliczka, D.M. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 100p. NTIS, PC A05/MF A01. Order Number DE83004792.

Thesis.

A temperature dependent photoemission study was performed on cerium metal to understand the role of the 4f electron in the isostructural γ-α phase transition. The partial yield spectra clearly indicate a 4f occupation number of one for both phases. The observed differences in the partial yield spectra consist mainly of a broadening of the multiplet structure. This broadening has been interpreted in terms of a slight delocalization of the 4f electron in transforming from the high volume γ phase to the more compact α phase. The energy distribution curves show two 4f related features in the valence band spectra. The feature located at -2.0 eV has been assigned to a direct emission of the 4f electron. The second feature is located near the Fermi level and has been attributed to a screening process involving the 5d valence electrons. Upon transforming to α-Ce, the screened feature increases in intensity at the expense of the direct feature. This has been interpreted as a decrease in the 4f-5d Coulomb repulsion. From the two complementary experiments, we conclude that both phases contain a single 4f electron that becomes slightly delocalized in the α-phase.

12681 **(IS-T—1040) Magnetic susceptibility of scandium-hydrogen and lutetium-hydrogen solid-solution alloys from 2 to 300°K.** Stierman, R.J. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 86p. NTIS, PC A05/MF A01. Order Number DE83004786.

Thesis.

Results for pure Sc show that the maximum and minimum in the susceptibility discovered earlier are enhanced as the impurity level of iron in scandium decreases. The Stoner enhancement factor, calculated from low-temperature heat capacity data, susceptibility data, and band-structure calculations show Sc to be a strongly enhanced paramagnet. Below 2°K, the magnetic anisotropy between the hard and easy directions of scandium decreases linearly with decreasing temperature, tending toward zero at 0 K. The large increase in the susceptibility of Sc at lower temperatures indicates magnetic ordering. Pure Lu and Lu-H alloys showed an anisotropy in susceptibility vs orientation; thus the samples were not random polycrystalline samples. Pure Lu shows the shallow maximum and minimum, but the increase in susceptibility at low temperatures is larger than previously observed. The susceptibility-composition dependence of the Lu-H alloys also did not match other data. The susceptibility-composition dependence does not match the composition dependence of the electronic specific heat constant below 150 K, showing the electronic specific heat is being affected by terms other than phonon-electron and pure electron-electron interactions.

12682 **(IS-T—1049) Study of the anomalous behavior of the electrical resistivity in alloys near the $PrNi_5$ composition.** Cho, W.D. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 43p. NTIS, PC A03/MF A01. Order Number DE83004787.

Thesis.

Temperature (300 to 4.2°K), composition, and heat treatment dependence of resistivity of PrNi/sub x/ (x = 4.6 to 5.2) were studied. Metallography of the as-cast samples revealed that only $PrNi_5$ is a single-phase alloy. Quenching from 1000°C produces a broader homogeneous region, from x = 5.0 to 5.2. Within the single phase region, the unit cell dimension decrease in the ao direction but increase in the co direction with increasing Ni content; total unit cell volume decreases with Ni content. 14 figures. (DLC)

12683 **(KAPL—4135) Corrosion rates and evaluations of structural materials on the North Atlantic Continental Rise.** Suss, H.; Williams, S.L; Barth, C.H.; Sheldon, R.B. (Knolls Atomic Power Lab., Schenectady, NY (USA)). Aug 1982. Contract AC12-76SN00052. 26p. NTIS, PC A03/MF A01. Order Number DE83004431.

Initial and steady-state corrosion rates were determined for carbon steel, low-alloy steel, series 300 stainless steels and Ni-Cr-Fe Alloy 600 at two stations in the Northwestern Atlantic Ocean. Corrosion specimens were deployed by submersibles at depths of 3000 and 3700 meters for up to three years. The experimental conditions were flowing, semistagnant, and stagnant seawater as well as complete burial in deep-ocean sediments. Mean steady-state corrosion rates for carbon and low-alloy steels ranged from 0.02 to 2.7 mils/year in the various seawater environments. Steady-state corrosion rates in the sediments were more variable and resulted in the highest observed rates of 6.40/year for carbon steel and 6.42 mils/year for HY-80 low alloy steel. Galvanic corrosion of carbon steel in contact with stainless steel resulted in significant accelerated corrosion of the carbon steel only in the flowing seawater and sediment environments. Corrosion rates for the corrosion-resistant alloys, including the stainless steels and Alloy 600, were extremely low averaging 0.0001 mil/year for the longer exposures. Some localized pitting and underdeposit corrosion were observed on a few specimens. The presence of carbon steel in direct contact with stainless steel protected the stainless steel from localized corrosion. This research provided insight into the nature of corrosion on the deep-ocean floor. 7 figures, 6 tables.

12684 **(LA-UR—82-3563) Direct spectrum-analysis method for obtaining the relaxation-time spectrum from relaxation-response data: amorphous metals.** Cost, J.R. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 10p. (CONF-821049—8). NTIS, PC A02/MF A01. Order Number DE83004734.

From TMS/AIME fall meeting; St. Louis, MO, USA (24 Oct 1982).

A method is described for determining without prior assumptions the distribution of relaxation times from the experimental relaxation response curve for a system approaching equilibrium by a single-step process following first-order kinetics. By analysis of computer-generated data with simulated random experimental error, the method is demonstrated to be capable of reproducing spectra with a single lognormal peak for a broad range of peak widths. This direct spectrum analysis method is applied to previously reported results for a relaxation in the metallic glass $Fe_{40}Ni_{40}P_{14}B_6$ and the previous result that the relaxation time spectrum for this relaxation contains four relatively sharp peaks is corroborated.

12685 **(LBL—14766) LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces.** Koestner, R.J. (Lawrence Berkeley Lab., CA (USA)). Aug 1982. Contract AC03-76SF00098. 415p. NTIS (US Sales Only). Order Number DE83004158.

Mf only; illegibility does not permit PC reproduction. Thesis.

There have only been a few Low Energy Electron Diffraction (LEED) intensity analyses carried out to determine the structure of molecules adsorbed on metal surfaces; most surface crystal-

lography studies concentrated on the structure of clean unreconstructed or atomic adsorbate-covered transition metal faces. The few molecular adsorption systems already investigated by dynamical LEED are CO on Ni(100), Cu(100) and Pd(100) as well as C_2H_2 and C_2H_4 adsorbed on Pt(111). The emphasis of this thesis research has been to extend the applicability of LEED crystallography to the more complicated unit cells found in molecular overlayers on transition metals or in there constructed surfaces of clean transition metals.

12686 **(NUREG/CR—2317-Vol.2-No.1) Container assessment: corrosion study of HLW container materials. Quarterly progress report, January-March 1982.** Ahn, T.M.; Soo, P. (Brookhaven National Lab., Upton, NY (USA)). Jun 1982. Contract AC02-76CH00016. 28p. (BNL-NUREG—51449-Vol.2-No.1). NTIS, PC A03/MF A01 - GPO. Order Number DE83002110.

Crevice corrosion products formed on titanium base materials exposed to WIPP Brine A at 150°C have been analyzed by obtaining electron diffraction patterns of oxide films which were selected from various positions on the crevice surface. The crevice corrosion products for CP titanium and TiCode-12 are mainly an anatase form of TiO_2. Both materials also showed trace amounts of Ti_3O_5. The intensity of the Ti_3O_5 peak in the diffraction pattern is stronger in CP titanium than in TiCode-12. More Ti_3O_5 is formed in the center of the crevice. From the study, it seems that the color differences of oxides inside the crevice are mainly due to optical interference colors caused by varying film thickness. The open-circuit corrosion potential behavior of CP titanium and TiCode-12 has been examined in acidified Brine A at 80°C. To reduce the potential effect of oxidizing impurities in test media these solutions were pre-electrolyzed. Both materials show breakdown of the passive film. TiCode-12 reaches a quasi steady state potential more rapidly than CP titanium. Breakdown of the passive film is attributed to the high chloride concentration with Ni being preferentially dissolved. Single-edged-notched tensile specimens have been used to obtain the apparent stress intensity factors at 2% crack extension in hydrogenated TiCode-12 with hydrogen concentrations up to 10,900 ppM. For high hydrogen levels the apparent stress intensity factor dropped roughly by a factor of 10 compared to nonhydrogenated TiCode-12. Fractographs show both alpha phase crystallographic fracture and alpha-beta interface cracking. These fractographs indicate that the formation of hydride is responsible for crack initiation for hydrogen concentrations above 5000 ppM.

12687 **(PNL—4379) Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments.** Pitman, S.G. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 34p. NTIS, PC A03/MF A01. Order Number DE83005126.

Statically loaded corrosion tests, slow strain rate (SSR) tests, and fatigue crack growth rate (FCGR) tests were conducted to evaluate the relative susceptibility of two titanium-base nuclear waste package candidate structural barrier materials Ti-grade 2 and Ti-grade 12-to environmentally enhanced cracking in a simulated repository environment. Statically loaded corrosion tests were done in oxic basalt ground water at 250°C; SSR tests were done in oxic basalt ground water at 150, 250, and 300°C and in air at 20 and 250°C; and FCGR tests were done in basalt ground water, fluoride-ion-enhanced basalt ground water, high-purity water, and air at 90°C. The following conclusions can be drawn: the general corrosion rate of statically loaded corrosion coupons was very low in a 3-mo test, and no pitting or cracking of the specimens was observed. Ti-grade 2 and Ti-grade 12 exhibited strain rate dependent ductility diminution in SSR tests. The ductility diminution was most severe in Ti-grade 2 at 300°C and in Ti-grade 12 at 250°C. For of Ti-grade 12 it was found to be highly orientation dependent. The ductility diminution was also found in tests conducted in air as well as in those conducted in the basalt ground water environment; however, the extent of the degradation was less in air. The ductility diminution cannot be attributed to stress corrosion cracking because the fracture mode was microvoid coalescence in all tests. Evidence obtained in the current study and correlation of the present results with results obtained by other researchers indicate that dynamic strain aging is responsible for the loss of ductility. The FCGR of Ti-grade 2 and Ti-grade 12 was not affected by any of the environmental conditions used in this study, which indicates that no environmental cracking mechanism is operative under the conditions tested (90°C, oxic ground water, and frequencies from 0.01 to 5 Hz).

12688 **(SAND—82-1279C) Some effects of microstructure and chemistry on corrosion and hydrogen embrittlement of TiCode-12.** Ruppen, J.A.; Diegle, R.B.; Glass, R.S.; Headley, T.J. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 9p. (CONF-821107—35). NTIS, PC A02/MF A01. Order Number DE83001364.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

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Effects of microstructure and chemistry on corrosion and hydrogen embrittlement of TiCode-12 have been investigated. Heat treating mill-annealed TiCode-12 in the temperature range 500 to 750°C results in a sensitization effect, i.e., an increase in the uniform corrosion rate when tested in either boiling 1N HCl or a $MgCl_2$ brine. This effect is caused by microstructural changes involving the precipitation of Ti_2Ni. Electrochemical studies indicate that sensitization results from galvanic coupling between Ti_2Ni, acting as cathode, and the α-Ti matrix with resultant shifts in corrosion potential. Increasing the Fe content of the alloy promotes the sensitization effect. Hydrogen embrittlement of TiCode-12 was studied using the slow strain rate technique. Hydrogen concentrations to 130 wppm did not cause embrittlement. However, above 220 wppm hydrogen, degradation was observed as a decrease in mechanical behavior and the appearance of cleavage-like secondary cracks. The embrittlement was dependent on temperature and alloy chemistry but not environment (air or brine).

12689 **(SAND—82-1524) Characterization of a procedure for preparing 6061 aluminum alloy for barrier anodization.** Panitz, J.K.G.; Sharp, D.J. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 40p. NTIS, PC A03/MF A01. Order Number DE83005383.

This procedure employs three etchants: 5% NaOH, 50% HNO_3, and concentrated HNO_3 - NH_4HF_2. The rate at which these etchants react with 6061-T6 aluminum alloy changes as they are used repeatedly, and also as they undergo environmental interactions during storage. Samples of 6061-T6 alloy which are processed in baths simulating the effects of usage and etchant-environment interactions were analyzed using Auger electron spectroscopy and electron microprobe analysis. Other samples which were prepared similarly were barrier anodized. The anodization voltage rise time to 950 V was used as a figure of merit for evaluating the practical effects of variations in the preparation chemistry sequence. It was observed that certain variations can make a significant difference in the anodization characteristics. For example, alloy samples which are only solvent cleaned typically take 113% more time to reach 950 V than samples which have been solvent cleaned and chemically etched. Samples which have been etched in 5% NaOH and 50% HNO_3 take 41% more time to reach 950 V compared to samples etched in all three etchants. 21 figures, 5 tables.

12690 **(UCID—19605) Coating Processes Group progress report, September-October 1982.** Dini, J.W.; Romo, J.G. (Lawrence Livermore National Lab., CA (USA)). 19 Nov 1982. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01. Order Number DE83004219.

Information on various aspects of surface coatings for metals is presented.

12691 **(UCRL—88400) Microstructural modification of aluminum-silicon alloy powders during dynamic consolidation.** Gourdin, W.H.; Smugeresky, J.E. (Lawrence Livermore National Lab., CA (USA)). 23 Nov 1982. Contract W-7405-ENG-48. 8p. (CONF-821223—1). NTIS, PC A02/MF A01. Order Number DE83003884.

From 3. conference on rapid solidification processing: principles and technologies; Gaithersburg, MD, USA (6 Dec 1982).

We describe the preliminary results of a study of the dynamic consolidation of a rapidly solidified aluminum-6% silicon alloy powder. The microstructure of this alloy, consisting of a dispersion

of silicon precipitates at the boundaries of essentially pure aluminum grains, provides an excellent grid against which to observe the changes induced by shock compaction. Examination of recovered specimens, shocked with either explosives or high velocity projectiles, shows that at low stress, high density is achieved without substantial interparticle bonding, and the microstructure is essentially that of the starting powder. For stresses between 1.7 and 2.6 GPa we observe increasing compact integrity, and the appearance of regions of altered microstrucure at the interfaces between powder particles. Above 4.0 GPa, such modified material is a distinctive feature of the microstructure, and compacts are well bonded. Increasing the stress serves not so much to increase the density as to increase the amount of energy deposited in the specimen. Bonding is the result of the local deposition of energy at particle interfaces during the passage of the shock. This energy may be calculated from the measured Hugoniot (shock compression) curve of the powder. It is suggested that through proper choice of stress level, structurally sound compacts can be formed with limited modification of the powder microstructure. 7 figures.

12692 **(Y/DV—252) Revision of the eutectoid isotherms of the uranium-chromium system.** Chapman, L.R. (Oak Ridge Y-12 Plant, TN (USA)). 13 Dec 1982. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE83004839.

The equilibrium γ-β transformation was observed at 738 +- 2°C for both heating and cooling at the equilibrium 0.001°C/s rate. 630 +- 10°C was judged to be the equilibrium β-α eutectoid isotherm. 5 figures. (DLC)

12693 **Assessment of carburization-decarburization behaviour of Fe-9Cr-Mo steels in a sodium environment.** Saltelli, A.; Chopra, O.K.; Natesan, K. (Argonne National Lab., IL (USA). Materials Science Div.). *Journal of Nuclear Materials;* **110**: No. 1, 1-10(Sep 1982).

A critical assessment is made of the carburization-decarburization kinetics of Fe-9Cr-Mo steels exposed to a sodium environment, using the available information on carbide phase morphology, chromium activity in a ferrite matrix, chromium carbide activity in mixed carbides, carbon solubility in Cr-Mo ferritic steels, and activity-concentration relationships based on α-phase/M_6C or $M_{23}C_6$ carbide equilibrium. Experimental data are presented on the decarburization of Fe-5Cr-Mo and Fe-9Cr-Mo steels at 973 K in a sodium environment to ascertain the long-term behaviour of these steels. The analysis shows that the decarburization of ferritic steels is largely dependent on the chemical reaction at the carbide/α interface and that at carbon activities > 0.04, the rate is predominantly determined by the dissolution of $(Fe, Mo)_6C$ carbides.

12694 **Chemical diffusion of Ta in γ-U in samples fabricated for positron studies.** Rothman, S.J.; Nowicki, L.J.; Fluss, M.J.; Smedskjaer, L.C.; Fogle, G.L.; Konicek, C.F.; Shinn, W.A. (Argonne National Lab., IL (USA). Materials Science Div.); Johnson, C.E. (Argonne National Lab., IL (USA). Chemical Engineering Div.). *Journal of Nuclear Materials;* **110**: No. 1, 55-58(Sep 1982).

A tantalum-jacketed high-purity uranium sample has been thermally cycled into the γ phase. Porosity formation in the uranium and interdiffusion with the Ta jacket were observed. The interdiffusion coefficient in the U-rich phase was between 10^{-14} and 10^{-13} $m^2 s^{-1}$ at 1037°C.

12695 **Cathodoluminescence of thorium in the presence of O_2, CO and gas mixtures of CO-O_2 and CO-H_2.** Vook, R.W.; Colmenares, C.A.; Smith, R.L.; Gutmacher, R.G. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Journal of Luminescence;* **27**: No. 2, 115-126(Aug 1982).

The cathodoluminescence (2-6 keV incident electrons) observed from thorium (111) and (533) crystal faces was recorded and analyzed for surfaces produced under various conditions. The blue luminescence observed in the presence of a partial oxygen pressure approx. equal to 133 μPa (approx. equal to 10^{-6} Torr) was found to consist of a broad asymmetric major band that peaked around 468 nm on which weak bands or lines were superimposed at approximately 433, 489, 502, and 534 nm. The emission was almost totally extinguished in the presence of a partial CO pressure approx. equal to 133 μPa (approx. equal to 10^{-6} Torr). The thorium-oxygen cathodoluminescence (CL) is interpreted as arising from the formation of ThO_2 and the excitation of luminescence centers by the incident electron beam and their subsequent decay. The major luminescence at 468 nm arises from F centers in ThO_2. The weak bands at 433 and 534 nm may arise from surface F^+ and F centers designated as Fsub(s)$^+$ and Fsub(s). The former may also be due to an OH luminescence center. The two longer wavelength lines (489, 502 nm) superimposed on the broad major band at approximately 468 nm are interpreted as arising from Pr^{+3} impurities in the thorium lattice that gave rise to fluorescence of ThO. The cathodoluminescence spectra observed in the presence of CO, and (CO+O_2) and (CO+H_2) gas mixtures were consistent with an interpretation that O_2 in the gas phase was required in order to obtain ThO_2 on and below the surface to produce significant luminescence. Auger spectroscopy showed that exposure to CO left approximately as much oxygen on the surface as in the case of O_2 but did not produce appreciable cathodoluminescence.

12696 **Causes for the variable superconducting transition temperature in uranium metal.** Sandenaw, T.A. (Los Alamos National Lab., NM (USA)). *Solid State Communications;* **43**: No. 5, 361-364(Aug 1982).

The variable superconducting transition temperature of uranium metal appears to depend upon the variability of a low-temperature martensitic transformation. Local structural fluctuations and phase instabilities are suggested as resulting when the transformation is incomplete. The thermodynamic stability of a two-phase modulated structure involving domain formation is discussed along with possible consequences of a domain configuration. Factors affecting Tsub(C) are used to explain the anomalous thermal property behavior of α-phase uranium.

12697 **Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga).** Oesterreicher, H.; Elton, J. (Univ. of California, San Diego, La Jolla). *Journal of Solid State Chemistry;* **43**: No. 3, 295-298(15 Jul 1982).

By partial substitution of Co in $LaCo_5$ by nontransition metals such as Al, an increase in H capacity (z) vis-a-vis $LaCo_5$ is achieved at pressures on the order of 100 atm at room temperature. Lower equilibrium pressures, P/sub e/, have been previously observed when compounds such as $PrCo_5$ and $LaNi_5$ were partially substituted on transition metal sites by nontransition metals such as Al, Be. This fact, coupled with the existence of the high-pressure phase $LaCo_5H$/sub z/ with $z \simeq 9$, suggests that the increased z is due to a lowering of P/sub e/ of the high-pressure phase to more modest conditions in temperature and pressure. The actual P(z) curves are, however, complex and reflect phenomenology often observed with pseudobinaries.

12698 **NMR in doped monocrystals of superionic conductor β-$LiAlSiO_4$ (β-eukryptite).** Brinkmann, D.; Mali, M.; Roos, J.; Schweickert, E. (Zurich Univ. (Switzerland)); Richards, P.M.; Biefeld, R.M. (Sandia National Labs., Albuquerque, NM (USA)). *Helvetica Physica Acta;* **54**: No. 4, 588(30 Jun 1982). (In German).

From Autumn meeting of the Swiss Physical Society; Davos, Switzerland (24 - 26 Sep 1981).

12699 **Effect of geometric shape on two-dimensional finite elements.** Cook, W.A. (Los Alamos National Lab., NM (USA)). *Nuclear Engineering and Design;* **70**: No. 1, 13-26(Jun 1982).

From 6. International seminar on computational aspects of the finite element method (CAFEM-6); Paris, France (24 - 25 Aug 1981).

Three quadrilateral elements are defined. These are an eight-nodal-point serendipity element (QUAD8s), a nine-nodal-point Lagrangian element (QUAD9l), and a nine-nodal-point quadrilateral element composed of two six-nodal-point triangular elements (QUAD9t). The effect that the geometric shape of the element has on the approximation function of each element is discussed. Two beam problems demonstrate that when the shape of the elements

becomes skewed, the QUAD9t element significantly improves the calculated results. Finally, a recommendation is made that the QUAD8s and QUAD9t be used together for the most efficient and accurate results.

12700 **Superconductivity and magnetism in metallic superlattices.** Schuller, I.K.; Falco, C.M. (Argonne National Lab., IL (USA)). *Thin Solid Films;* **90**: No. 2, 221-227(16 Apr 1982).

From 5. International thin films congress; Herzlia-on-Sea, Israel (21 - 25 Sep 1981).

The preparation, structural and physical properties (superconductivity and magnetism) of metallic superlattices prepared by a sputtering technique developed by the authors are presented. X-ray diffraction, ion mill Auger and ion scattering spectroscopy, superconducting Tsub(c) and Hsub(c) values, as well as magnetization measurements, are described.

12701 **Acoustic emission under biaxial stresses in unflawed 21-6-9 and 304 stainless steel.** Hamstad, M.A. (Lawrence Livermore National Lab., CA); Leon, E.M.; Mukherjee, A.K. *Metal Science;* **15**: 541-548(Nov 1981). Contract W-7405-ENG-48.

Acoustic emission (AE) testing has been carried out with uniaxial and biaxial (2:1 stress ratio) stressing of smooth samples of 21-6-9 and 304 stainless steel (SS). Uniaxial testing was done with simple tensile and compression samples as well as with the special biaxial specimens. Biaxial tensile stressing was accomplished with a specially designed specimen, which had been used previously to characterize AE in 7075 aluminium under biaxial stressing. Results were obtained for air-melt and for vacuum-melt samples of 21-6-9 SS. The air-melt samples contain considerably more inclusion particles than the vacuum-melt samples. For the 304 SS, "as received" material was examined. To allow AE correlations with microstructure, extensive characterization of the 21-6-9 microstructure was carried out. Significant differences in AE occur in biaxially stressed specimens as compared to uniaxially stressed samples.

12702 **(ORNL-tr—4886) Mirror finishing of metals using the electrolytic-abrasive mirror-finishing method.** Tamiya, K.; Honda, S.; Maehara, H.; Kamada, H. Translated from *Hitachi Zosen Giho ;* **42**: No. 3, 153-160(1981). Contract W-7405-ENG-26. 18p. NTIS (US Sales Only). Order Number DE82022501.

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Using the electrolytic-abrasive mirror-finishing method, a large area of stainless and ordinary steel metal works can be easily mirror-finished in a short time and with high efficiency up to a surface roughness of 0.01 to 0.02 μ mR/sub max/. This method is based on the fact that the electrolytic action is assisted by the removing action of abrasive grains within an appropriate current density range by using passivation-type electrolytes. This paper first of all describes the basic characteristics of surface finishing on planes, cylindrical works, and curved surfaces when this method is used. Furthermore, it introduces the results of using the electrolytic-abrasive mirror-finishing method in a few typical applications: a chemical reactor, stainless steel substrate for amorphous-silicon solar cells, a large-size cylindrical work in a diesel engine, etc. 27 figures.

12703 **(ORNL-tr—4888) Determination of the corrosion rate of Ni-Fe coatings by measuring polarization resistance.** Kunceva, M.; Tupy, J.; Tlamsa, J. Translated from *Koroze a Ochrana Materialu ;* **25**: No. 1, 1-3(1981). Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE83000250.

From the results, the method is suitable for determination of the corrosion rate of the alloy coating in various media and with various corrosion mechanisms. It was determined that the corrosion rate of glossy alloy coatings (containing sulfur) is very low and its values are approximately 65 times lower in the solution of sulfuric acid and 4 times lower in the CASS solution compared to alloy coatings produced in a bath without gloss-producing additives. In glossy Ni-Fe alloy coatings, corrosion rates in the solution of sulfuric acid and in the CASS solution remain almost unchanged when the Fe content is gradually increased to 35%. This may be an important factor when utilization of these coatings in the area of decorative and protective metal plating is considered.

12704 **(RFP-Trans—339) Electron-beam welding of aluminum alloys.** Brillant, M.; de Bony, Y. Translated from *Materiaux et Techniques ;* 318-330(Aug-Sep 1980). Contract AC04-76DP03533. 29p. NTIS, PC A03/MF A01. Order Number DE82021037.

Portions of document are illegible.

Objective of this article is to describe the status of the application of electron-beam welding to aluminum alloys. These alloys are widely employed in the aeronautics, space and nuclear industries.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 11846, 11957, 12370, 12681

12705 **(BMI—2101) Failure of ceramics from multiaxial stresses. Second progress report, November 2, 1981-October 31, 1982.** Rosenfield, A.R.; Duckworth, W.H.; Jankovich, E.; Sampath, S.G.; Shetty, D.K.; Tsay, C.S. (Battelle Columbus Labs., OH (USA)). 18 Nov 1982. Contract W-7405-ENG-92. 3p. NTIS, PC A02/MF A01. Order Number DE83005038.

Even though care was taken to insure isotropic flaws and to eliminate directionality in alumina, glass, and a glass-ceramic, residual stresses are still present that influence strongly the crack branching. In glass, the branching constant in biaxially loaded plates is equal to the mirror constant in uniaxially loaded plates. Alumina shows a biaxial strengthening effect as does glass-ceramic. Neither Weibull theory nor Batdorf's theory completely accounts for the experimental data in alumina. For both glass-ceramic and alumina, biaxial strengths are more stress-rate dependent than uniaxial strengths. (DLC)

12706 **(DOE/ER/01198—1395) Fracture of hot-pressed silicon nitride at elevated temperatures.** Knickerbocker, S.H. (Illinois Univ., Urbana (USA). Dept. of Ceramic Engineering). 1983. Contract AC02-76ER01198. 304p. NTIS, PC A14/MF A01. Order Number DE83005236.

Thesis.

MgO-doped and Al_2O_3-Y_2O_3-doped hot-pressed silicon nitrides were fractured between 1100 and 1350°C in four-point bend at three displacement rates. Fracture stress and critical stress intensity factor were plotted vs temperature for each displacement rate. Fracture stress and critical stress intensity factor showed a strain rate dependence above 1200°C. The MgO-doped Si_3N_4 exhibited a peak in fracture stress before the values decreased at high temperatures. This peak corresponds to the onset of subcritical crack growth prior to catastrophic failure. Subcritical cracking is believed to occur by the nucleation, growth and coalescence of cavities in the secondary, amorphous grain boundary phase. The coalescence of cavities along with grain boundary separation results in the formation of microcracks in the vicinity of the main crack. The main crack then advances slowly by joining up with these nearby microcracks. Cavities and regions of grain boundary deformation were observed with SEM and TEM. A map was drawn of displacement rate versus temperture showing regions where subcritical cracking was and was not observed as well as a transition region. Both silicon nitrides exhibited a peak in effective critical stress intensity factor prior to the decrease. A decrease in K_1/sub C/ results as the material weakens at high temperatures. The Y_2O_3-Al_2O_3-doped silicon nitride sustained its strength and K_1/sub C/ to higher temperatures due to its more refractory Y_2O_3-Al_2O_3-SiO_2 crystalline compound grain boundary phase than the amorphous magnesium-silicate phase present in the MgO-doped silicon nitride.

12707 **(DOE/ER/01198—1396) Orientation of ceramic microstructures by hot-forming methods.** Knickerbocker, J.U. (Illinois Univ., Urbana (USA). Dept. of Ceramic Engineering). 1982. Contract AC02-76ER01198. 195p. NTIS, PC A09/MF A01. Order Number DE83005232.

Portions of document are illegible. Thesis.

Powders of layered-structure compounds Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$ and $Bi_4Ti_3O_{12}$ were prepared by solid-state calcination and salt synthesis. Powders were fabricated into dense ceramics by hot-pressing, hot-forging, and hot-extrusion. Microstructures

showed little grain orientation in hot-pressed samples. However, hot-forged samples had microstructures with up to 99% grain orientation, and hot-extruded samples had up to 92% grain alignment. Greater grain sizes were observed for hot-forged and hot-extruded microstructures than for hot-pressed. Anisotropy of dielectric constant, tangent ∂, ac conductivity, dc resistivity, ferroelectric and piezoelecric properties were measured. Significant dielectric anisotropy occurred for hot-forged Bi_2MoO_6, $PbBi_2Nb_2O_9$ and $Bi_4Ti_3O_{12}$, with pseudo single-crystal values for $PbBi_2Nb_2O_9$ and $Bi_4Ti_3O_{12}$. Salt synthesized powders were electrically aligned by dielectrophoretic poling prior to hot-forging, and the degree of three dimensional grain orientation was determined. Dielectric constants were in good agreement with single crystal data and values calculated from dielectric mixing rules. The best powders for dense grain-oriented microstructures had small grain sizes for sintering activity, had large aspect ratios for mechanical grain alignment, and were deagglomerated for dielectrophoretic alignment. Thoroughly washed salt synthesized powders were required for dielectrophoretic poling experiments. Hot-forging produced the greatest combination of grain orientation and fired densities.

12708 **(DOE/ER/10428—T2) Characterization of imperfections in plasma-sprayed titania.** Berndt, C.C.; Kolipari, R.; Zatorski, R.A.; Herman, H.; Jonca, A.; Templeton, T.; MacCrone, R.K. (State Univ. of New York, Stony Brook (USA); Rensselaer Polytechnic Inst., Troy, NY (USA)). 1982. Contract AC02-79ER10428. 8p. NTIS, PC A02/MF A01. Order Number DE83004813.

Portions of document are illegible.

Magnetic measurements have been shown in this investigation to be a powerful method of obtaining new information about plasma-sprayed oxides (TiO_2). It has shown that significant interaction in the form of substrate melting occurs on the impingement of the molten particles, lending support to the ideas of Dallaire. Although the temperature dependence suggests metallic inclusions, the deduced magnetization is not in agreement with the magnitude appropriate for iron. Indeed, the magnetization is less than the likely ferritic phases. The estimated thickness of the magnetic phase is very reasonable. As expected, the predominant ionic defect detected was the Ti^{+3} ion, in concentrations very similar to titania, reduced under moderate conditions. In principle, the Ti^{+3} ion concentration can be determined quantitatively and related to the spraying parameters.

12709 **(DOE/ER/12044—1) Characterization and analysis of cavity development during creep of ceramics at elevated temperature. Progress report, 1982.** Page, R.A.; Lankford, J. Jr. (Southwest Research Inst., San Antonio, TX (USA)). 14 Dec 1982. Contract AS05-82ER12044. 42p. NTIS, PC A03/MF A01. Order Number DE83003586.

Small angle neutron scattering was used to study compression-crept Lucalox alumina. Although cavities were initially present, significant cavity nucleation during creep nevertheless occured. The data does not support the presence of an incubation time for cavity nucleation. Total cavity volume was a linear function of strain over the entire range measured. Grain size had a marked effect on the slope of the cavity volume versus strain curve. Average cavity size was on the order of .1 μm and was found to be relatively constant throughout the strain range measured. Cavitation was not restricted to triple points, i.e., multiple cavities were nucleated on each grain facet. This has important implication for cavitation modeling. 6 figures.

12710 **(INIS-mf—7463) Incorporation of atomic carbon and hydrogen in high-melting oxide - nuclear-chemical, dilatometric and infrared spectroscopical investigations on C- and H-doped MgO and CaO-monocrystals.** Wengeler, H. (Koeln Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 7 Jun 1980. 314p. (In German). NTIS (US Sales Only), PC A14/MF A01. Order Number DE83780183.

Thesis.

C and H doped monocrystals of MgO and CaO were investigated in a temperature region of 78 K to 1500 K for the chemical state of the doping agents and their temperature-dependent behaviour. Starting with monocrystals obtained by coal arcing, carbon doping was carried out via the nuclear reaction ^{13}C (d,p)^{13}C, whereas hydrogen doping is present from the start of the crystal growth due to remaining moisture of the initial product. Hydrogen is present in the form of OH-contained defects or secondary produced Hz bubbles. All investigations, namely laser microprobe investigations, infrared spectroscopy, CO_2 and hydrocarbon formation measurements and argon and O_2 atmosphere, C-profile measurements, diffusion measurements, thermal expansion, lead to the result that carbon in the atomic form is present in the lattice on interstitial places or cation vacancies. The reaction mechanisms are discussed. An interaction model (between OH and C defects) does not completely clarify the complex IR spectra in detail, however shows good agreement with the experimental results.

12711 **(IS-T—951) Electron-energy-loss and ultraviolet-photoemission study of VN/sub x/, NbN/sub x/, and ZrN/sub x/.** Schubert, W.K. (Ames Lab., IA (USA)). Jan 1982. Contract W-7405-ENG-82. 175p. NTIS, PC A08/MF A01. Order Number DE83004986.

Thesis.

The combination of in situ fabrication and characterization by AES, ELS, and UPS has provided reliable data about the electronic structure and collective electron behavior of VN/sub x/ NbN/sub x, and ZrN/sub x/. 50 fugures, 10 tables.

12712 **(IS-T—998) Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen, and vanadium alloys.** Nelson, S.O. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 80p. NTIS, PC A05/MF A01. Order Number DE83004976.

Thesis. Submitted to Iowa State Univ., Ames.

The dissolution of H gas has been studied using pressure-composition isotherms in Sr, Th-N and V alloys containing either Nb, Cr or Ti. Direct H equilibrium vapor pressure measurements were performed in the Sr-H and Th-N-H systems at 973 to 1173°K and 623 to 1123°K, respectively. Isopiestic solubility was used to measure the H equilibrium pressures for the V alloys at 223 to 473°K. In all the alloys studied, the reaction of hydrogen with the metal phase was exothermic and hydrogen followed Sieverts' law over a considerable range of hydrogen concentration. The enthalpy of solution of H in the Sr and the enthalpy of formation of ThNH/sub x/ are -14.3 +- 1.2 kcal;/mol H and -16.3 +- 1.5 kcal/mol H_2, respectively. Enthalpies of solution of H for the V alloys ranged from -8.0 to -10.5 +- 0.3 kcal/mol H. Additions of T to V dramatically enhanced the isopiestic solubility of H, Cr significantly reduced the solubility and Nb moderately increased the solubility. Sieverts' law behavior for H in the V alloys showed that substitutional atoms did not act as deep traps for H.

12713 **(IS-T—1030) Spin-lattice relaxation of protons in scandium dihydride.** Lu, L.T. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 82p. NTIS, PC A05/MF A01. Order Number DE83004796.

Thesis. Submitted to Iowa State Univ., Ames.

By using pulsed NMR, the spin-lattice relaxation time T_1 of the protons in ScH/sub x/ (x = 1.73, 1.75, 1.79, 1.83, 1.87, 1.97, 2.02) was measured at 4.2 to 800°K to determine the hydrogen locations and interstitial self-diffusion parameters, the electronic structure and the dynamic effect caused by paramagnetic impurities. The fact that the temperature of the (T_1)/sub min/ increases with hydrogen concentration (H), as well as the fact that no trihydride phase is formed, strongly suggest that negligible O-site occupancy occurs in ScH/sub x/. Analysis of the T_1 data shows that the activation energy and jump frequency of hydrogen atomic diffusion decrease as H increases. The relaxation rate T_1^{-1} in the rigid lattice regime is the sum of the relaxation rate T/sub 1e/$^{-1}$ due to conduction electrons and the relaxation rate T/sub 1p/$^{-1}$ due to residual paramagnetic impurities (< 10 atomic ppM). The Korringa constant T/sub 1e/T increases with H from 304 s-K in $ScH_{1.73}$ to 433 s-K in $ScH_{2.02}$. Therefore, the conduction electron density of ScH/sub x/ at the Fermi level decreases with H. In the rigid lattice regime, the impurity-contributed relaxation rate T/sub 1p/$^{-1}$ is mainly caused by very low levels of Gd^{+3} ions in our samples; T/sub 1p/$^{-1}$ is independent of temperature and roughly proportional to the level of Gd impurity. When Gd increases to ≈ 7 ppM, T/sub 1p/$^{-1}$ increases with decreasing temperature below 100°K. Theory suggest that in the rigid lattice regime, ^1H T/sub 1p/$^{-1}$ is

primarily caused by ^1H spin diffusion and that the contribution from the RKKY interaction is negligible. Even with such low levels of Gd impurity, the diffusion-impurity-associated T/sub 1p/ $^{-1}$ is clearly observed. Above the rigid lattice regime, ^1H atommic diffusion may become a second main source for the ^1H diffusion-impurity-associated T/sub 1p/$^{-1}$.

12714 **(IS-T—1039) Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides.** Horng, H.E. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 105p. NTIS, PC A06/MF A01. Order Number DE83004794.

Thesis.

Many high superconducting transition temperature (T/sub c/) superconductors have been discovered in rare earth transition metal borides, such as some compounds in the primitive tetragonal $RERh_4B_4$, body-centered tetragonal $RERu_4B_4$ or orthorhombic $RERuB_2$ systems. The high transition temperatures present in many of those compounds as well as the regular sublattice of rare earth atoms provide an opportunity for studying the interaction of superconductivity and long range magnetic order. The close correlation between superconductivity, magnetic order and structural features is demonstrated with the study of the pseudoternary systems Er(Rh/sub 1-x/Ru/sub x/)$_4B_4$, Y(Rh/sub 1-x/Ru/sub x/)$_4B_4$ and (Lu/sub 1-x/Er/sub x/)RuB_2. The systematic investigation of the role of each atom in the particular ternary boride structure is addressed by low temperature measurements of electronic, transport and magnetic properties as well as by metallurgical methods. Results are reported.

12715 **(SAND—82-1483C) Densification kinetics of shock-activated nitrides.** Beauchamp, E.K.; Loehman, R.E.; Graham, R.A.; Morosin, B.; Venturini, E.L. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 14p. (CONF-821133—3). NTIS, PC A02/MF A01. Order Number DE83003008.

From Conference on ceramic science - emergent process methods for high technology ceramics; Raleigh, NC, USA (8 Nov 1982).

Explosive shock treatment of AlN and Si_3N_4 increases point defect concentrations by more than an order of magnitude and dislocation densities to 10^{15} to $10^{16}/m^3$. Large increases in hot press densification rates for shocked AlN can be attributed to the dislocations. Similarly, the rate of the α-β crystallographic transition in Si_3N_4-MgO mixtures is significantly enhanced by shock-induced dislocations and defects. 5 figures.

12716 **(UCRL—88181) Explosive consolidation of aluminum nitride ceramic powder: a case history.** Gourdin, W.H.; Weinland, S.L.; Echer, C.J.; Huffsmith, S.L. (Lawrence Livermore National Lab., CA (USA)). 1982. Contract W-7405-ENG-48. 15p. (CONF-821133—2). NTIS, PC A02/MF A01. Order Number DE83003876.

From Conference on ceramic science - emergent process methods for high technology ceramics; Raleigh, NC, USA (8 Nov 1982).

A case study of the explosive consolidation of A1N is presented. Measured and calculated stress histories show a two-wave structure during the initial compaction, consisting of an ingoing pulse and an outgoing pulse reflected from the cylinder axis. The macrostructural features of the consolidated specimen are rationalized and discussed in terms of this observed stress history. It is suggested that the second shock determines, at least in part, the final density of the compact. Examination of eat treated specimens in the transmission electron microscope (TEM) shows that recovery of the heavily dislocated microscope (TEM) shows that recovery of the heavily dislocated microstructure is rapid at 1500°C, and, further, that the amorphous intergranular phase disappears. A dispersion of fine precipitates appears at grain boundaries during heat treatment as well. The fracture toughness of explosively consolidated specimens, 3.0 MPa m/sup 1/2/, is the same as that of hot-pressed material, indicating that explosive consilidation is a viable means of producing dense, well bonded A1N. 7 figures, 1 table.

12717 **(RFP-Trans—352) Fireproof ceramics and process for their manufacture.** Stradley, N.H.; Dunegan, H.C. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Dec 1982. Contract AC04-76DP03533. Translation of German Patent 2,214,523. 10p. NTIS, PC A02/MF A01. Order Number DE83005021.

Hard,wear-resistant ceramics which are practically not porous, are the object of this invention. They comprise a solid solution of alumina and chromium oxide. They are made by a process in which a porous ceramic article of alumina is impregnated at least 5 times up to saturation with an aqueous chromic acid solution, then heated to 600 to 1000°C to remove the solvent and reduce the chromic acid, and heated to 1100 to 1400$_0$C. Hardness, wear resistance, and abrasion resistance data are given. (DLC)

12718 **Vapor pressures and vapor compositions in equilibrium with hypostoichiometric uranium dioxide at high temperatures.** Green, D.W.; Leibowitz, L. (Argonne National Lab., IL (USA). Chemical Engineering Div.). *Journal of Nuclear Materials;* **105**: No. 2/3, 184-195(Feb 1982).

Thermodynamic functions of the gaseous species, thermodynamic functions of the condensed phase, and an oxygen-potential model have been combined to calculate the vapor pressures and vapor compositions in equilibrium with condensed-phase UOsub(2-x) for 1500 <= T <= 6000 K and O <= chi <= 0.5. A method for extending the oxygen-potential model of Blackburn to the liquid region has been derived and evaluated. Results of these calculations show that the oxygen-to-uranium ratio of the vapor is larger than that of the condensed phase with which it is in equilibrium for most of the ranges of T and x of interest. Near 6000 K the vapor is very oxygen-rich so that the composition of the condensed phase would be changed considerably by even a few percent vaporization. In general, the vapor in equilibrium with UOsub(2-x) is poorly approximated at UO_3(g); the species U, UO, UO_3, O_2, and O each have higher partial pressures than UO_2 for some conditions. The calculated total pressures at high temperatures are in good agreement with those recommended by the International Working Group on Fast Reactors (IWGFR).

12719 **NMR study of phase transitions in VT/sub 0.50/ and VT/sub 0.75/.** Bowan, R.C. Jr.; Attalla, A.; Tadlock, W.E.; Sullenger, D.B.; Yauger, R.L. (Monsanto Research Corp., Miamisburg, OH). *Scripta Metallurgica;* 933-938(1982). Contract AC04-76DP00053.

The preparation of polycrystalline VT/sub 0.50/ and VT/sub 0.75/ and the observations of phase transitions using pulse nuclear magnetic resonance (NMR) measurements of triton relaxation times are described. The critical temperatures (T/sub c/) for the phase transitions in the VT/sub x/ samples follow the mass-dependent trends experimentally found for VH/sub x/ and VD/sub x/ and also qualitatively obey the isotopic dependence predicted by the simple theoretical models. (JMT)

3603 Composite Materials

REFER ALSO TO CITATION(S) 13374

12720 **(Y/Sub—80-7733/1-01) Residual strain and strength loss in filament wound circular rings. Final report, October 13, 1980-September 30, 1981.** Dobie, M.J.; Leavesley, P.J.; Knight, C.E. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Aug 1982. Contract W-7405-ENG-26. 93p. NTIS, PC A05/MF A01. Order Number DE83005073.

Very high strength composite materials may be formed by the filament winding process using continuous filament yarns and a resin binder. The composite strength depends on the fibers being imbedded in the resin matrix in a straight path. This research aims at quantifying the relationships between fiber winding tension, mandrel stiffness, winding thickness, and composite strength. An analytical model is developed based upon the finite element method which models the winding process. Two types of cylinders were fabricated for experimental correlation with the analytical model.

12721 **Problems and solutions in using short fiber reinforcements.** Milewski, J.V. (Los Alamos National Laboratory, Los Alamos, NM). pp 8p, Session 18-A of Reinforced plastics/composites institute. New York, NY; Society of the Plastics Industry, Inc. (1981).

From 37. annual technical conference on reinforced plastics/composites; Washington, DC, USA (11 Jan 1982).

The performance potential and current technical and economic shortcomings of short fiber reinforcements are assessed. Short fibers include (1) monocrystalline whiskers, such as those of silicon carbide, which offer the highest tensile strength and elastic modulus achievable but remain the most expensive reinforcement alternative, (2) microfibers, which are of lower cost than whiskers and have a polycrystalline microstructure whose imperfections significantly lower a given material's strength, (3) processed mineral fibers, which are produced by fiberizing blast furnace slag and are of low cost and glass fiber-like performance, (4) natural mineral fibers such as Wollastonite, and (5) chopped and milled fibers, whose precursors are continuous glass, carbon/graphite and aramid polymer fibers, as well as metal fibers. Attention is given to the mixing and blending and fiber orientation problems encountered in the use of short fibers, and recommendations are made toward their solution.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 12119, 12846

12722 **(BDX—613-2848) Synthesis and characterization of diallyl phthalate prepolymers.** Baker, G.K.; Parker, B.G. (Bendix Corp., Kansas City, MO (USA)). Dec 1982. Contract AC04-76DP00613. 23p. NTIS, PC A02/MF A01. Order Number DE83004945.

Methods for the laboratory synthesis of diallyl phthalate prepolymers were evaluated. The chemical, physical, and molecular weight properties of several prepolymers synthesized were also evaluated and compared to those properties exhibited by Dapon 35 and Daiso 35, manufactured by FMC Corporation and Osaka-Soda, respectively. Glass-filled molding compounds from four of the prepolymers having molecular weight distributions ranging from 1.9 to 40.2 were prepared and tested at the Monsanto Research Corporation, Mound Facility. The processing characteristics and physical and electrical properties of two molding compounds were found to be comparable to similar compounds made from Dapon 35 and Daiso 35.

12723 **(LA—9559-MS) Simple EOS for branched (low-density) polyethylene.** Dowell, F. (Los Alamos National Lab., NM (USA)). Oct 1982. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01. Order Number DE83003896.

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A simple equation of state (EOS) for branched (low-density) polyethylene was generated and added to the T-4 Sesame EOS Library as material number 7171. This EOS is intended to replace an earlier EOS (material number 7170) for this substance. This new EOS for polyethylene reproduces the experimental shock Hugoniot data for the initial state density rho/sub o/ = 0.916 g/cm^3 or Mg/m^3.

12724 **(LA—9564-MS) Simple EOS for linear (high-density) polyethylene (Marlex).** Dowell, F. (Los Alamos National Lab., NM (USA)). Nov 1982. Contract W-7405-ENG-36. 14p. NTIS, PC A02/MF A01. Order Number DE83004996.

Portions of document are illegible. Printed copy available until stock is exhausted.

A simple equation of state (EOS) for linear (high-density) polyethylene (Marlex) was generated and added to the T-4 Sesame EOS Library as material number 7180. This new EOS for Marlex reproduces the experimental shock Hugoniot data for the initial state density rho_o = 0.954 g/cm^3 or Mg/m^3.

12725 **(SAND—82-1903C) Rheology of thermoplastic foam extrusion.** Kraynik, A.M. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 28p. (CONF-8205141—1). NTIS, PC A03/MF A01. Order Number DE83004013.

From 41. annual technical conference of the Society of Plastics Engineers; Chicago, IL, USA (2 May 1982).

A phenomenological model of flow in an extrusion die has been developed. The macroscopic effect of the phase change from a homogeneous polymer melt, that contains a blowing agent, to a foam can be described in terms of two dimensionless parameters, α and θ. α is defined as the ratio of the pressure gradient in the melt phase to the average pressure gradient in the foam phase. θ is the corresponding ratio of pressure differences in the melt and foam phases. The position at which the phase change initiates, the exit contribution to the Bagley ends pressure correction, and the true wall shear stress in the melt phase can be related to α and θ. The data of Han and Villamizar, who measured pressure distribution in a transparent extrusion die and directly observed the phase change, are used to calculated α and θ. The prediction of these parameters is discussed. The observation that product quality generally improves with increased extrusion rates may be related to the position at which the phase change from a homogeneous melt to a foam initiates. A mechanism which supports this connection is described.

12726 **(UCRL—15512) Characterization of Kevlar 49 fibers by electron paramagnetic resonance. Final report, 20 May 1981-20 June 1982.** Brown, I.M.; Sandreczki, T.C. (McDonnell Douglas Research Labs., St. Louis, MO (USA)). 20 Jun 1982. Contract W-7405-ENG-48. 44p. (MDC-Q—0775). NTIS, PC A03/MF A01. Order Number DE83004218.

EPR was used to investigate the free radicals created in Kevlar 49 fibers by stress-induced and photo-induced macromolecular chain scissions. Mn^{+2} ions were identified from the EPR spectrum of frozen solutions of concentrated sulfuric acid containing Kevlar 49. Other ions present are Cu^{+2}, and possibly Fe^{+3}, Cr^{+3}, and Ti^{+3}. EPR lineshape anisotropy indicates that some of the metal ions and first coordinate spheres are oriented. The concentration of stress-induced radicals (2 x 10^{10} per filament) suggest that chain scission occurs in more weak planes than are estimated to exist in the fracture surfaces of the fiber core. These radicals are unstable in air and have some aromatic character. Several different types of radicals were obtained following uv irradiations of the Kevlar 49 fibers in vacuum (photodegradative radicals) and in air (photo-oxidative radicals). The photodegradative radicals are identified with primary radicals involved in the photo-Fries rearrangement reaction, secondary radicals formed as a result of a hydrogen atom abstraction by the primary radical, and/or ketyl radicals produced as a result of uv irradiation of the photo-Fries rearrangement product. The photo-oxidative radicals are identified with the uv irradiation products of a peroxide intermediate. Lineshape anisotropy indicates that both radical types are oriented. 31 figures.

12727 **(UCRL—53298) Evaluation of the use of HiSil 233 in silicone elastomers and cellular silicones.** Cady, W.E.; Jessop, E.S.; McKinley, B.M. (Lawrence Livermore National Lab., CA (USA)). Aug 1982. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01. Order Number DE83005029.

The presence or absence of HiSil 233 SiO_2 in the reinforced gum of three silicone polymers (SE54, L97KVB, and L6OVB) does not cause any significant variation in the load-deflection properties of the cellular silicones made from the three polymers and does not affect the compression set of the cellular silicones. There is no evidence that HiSil 233 is required to provide oxidation resistance during the high-temperature post-cure cycle of the cellular silicone. 8 tables.

12728 **(UCRL—87546-Rev.1) Curing behavior of seven segmented polyurethane adhesives.** Hoffman, D.M. (Lawrence Livermore National Lab., CA (USA)). 1 Jun 1982. Contract W-7405-ENG-48. 19p. (CONF-820909—11-Rev.1). NTIS, PC A02/MF A01. Order Number DE83004287.

From National meeting of the American Chemical Society; Kansas City, MO, USA (1 Sep 1982).

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Investigation into the dynamic viscosity change on curing of seven segmented polyurethane polymers has shown that initial viscosities decrease with temperature while the rate of cure and change in viscosity depend directly on temperature. The polyurea hard segment (87 and 88) systems cured more rapidly than polyurethane hard segment (73) systems. By using iron catalysts the cure rate of the polyurethane hard segment systems begins to approach that of the 87 and 88 systems. For an as yet undetermined reason no definite evidence of gelation or vitrification was found in the dynamic mechanical measurements on these systems during cure even though the hard segment glass transitions for the polyurea systems are well above the cure temperature. The observed liquid-liquid phase separation in 73 systems at low curing temperatures implies the presence of an upper critical solution temperature and/or chemical compatibilization of the MDI terminated polyether during cure at the higher temperatures. All of these cured adhesives have low to intermediate moduli over a wide temperature range, bond rapidly and well to most substrates, and can be cured at room temperature or accelerated with heat in modestly dry environments. At cure temperatures above 60 to 80°C some side reactions may occur reducing the properties of the cured adhesives. 8 figures.

12729 **(BDX—613-2874) Method for the preparation of polymers.** Aime, M.; Nakata, T. (Bendix Corp., Kansas City, MO (USA)). Nov 1982. Contract AC04-76DP00613. Translation of Japanese Patent 1963-10,344. 16p. NTIS, PC A02/MF A01. Order Number DE83004941.

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Polymerization method for the preparation of prepolymers through the polymerizations of diallyl phthalate is disclosed, in which an ether of a phenol and allyl alcohol or an organotin compound is added the amount of 0.1 to 5% by weight based on the amount of diallyl phthalate.

3606 Other Materials

REFER ALSO TO CITATION(S) 11866, 11867, 11878, 12043, 12044, 12050, 12060, 12062, 12098, 12119, 12178, 12780, 12885, 12886, 12886, 12913, 12974, 13215, 13216, 13375

12730 **(BARC—1133) Determination of surface area of glass grains by adsorption of methylene blue and its application in the testing of relative impact strength of glasses.** Seshadri, K.S.; Shukla, B.S.; Rastogi, R.C.; Sunder Rajan, N.S. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 33p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703374.

Surface area of glass grains by adsorption of methylene blue has been determined. Effects of variables such as pH, glass compositions, and equilibration time on the adsorption of methylene blue on glass surfaces have been evaluated. Conditions to determine relative surface area of glass-pieces/glass-grains by adsorption of methylene blue have been found out. The method has been successfully applied to compare the impact strength of glasses by measuring the surface area of the shattered pieces generated in shattering test unit.

12731 **(CONF-821107—41) Characterization of single-crystal mercuric iodide (HgI_2) using thick detector structures.** Beyerle, A.; Hull, K.; Markakis, J.; Schnepple, W.; Van Den Berg, L. (EG and G, Inc., Goleta, CA (USA). Energy Measurements Group). 1982. Contract AC08-76NV01183. 8p. NTIS (US Sales Only). Order Number DE83004678.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

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Single crystal sections of HgI_2 (about 1 cm thick) have been evaluated for charge carrier transport properties. Using these thick detector structures, surface effects produced during fabrication are reduced, enhancing the bulk property characteristics. The standard time-of-flight method was used to determine electron and hole mobilities. Lifetime measurements for electrons and holes were made by direct observation of the carrier decay where crystal transit times were long compared to lifetimes. Nonlinear charge carrier velocities have been observed during mobility measurements. These nonlinearities impair a partial charge collection technique for spectra generation taken with thick detectors while having a lesser effect on the standard full charge collection approach. Partial charge collection methods have produced greater peak efficiencies than full charge collection, and investigations of crystal properties are being used to enhance this method.

12732 **(DESY-SR—82-04) Partial cross sections and density of states effects in the valence band photoemission from solid nitrogen.** Lau, H.J.; Fock, J.H.; Koch, E.E. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1982. 7p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750939.

Photoelectron energy distribution curves from solid nitrogen have been measured for excitation energies ranging from threshold (14.2 eV) to 40 eV using Synchrotron Radiation. The partial cross sections for the emission from the 3sigmasub(g), 1πsub(u) and 2sigmasub(u) derived valence bands show pronounced maxima 3.4 eV, 2.9 eV and 3.0 eV above the vacuum level respectively which we interpret as being due to a high density of conduction band final states. These states are closely related to the πsub(g)* negative-ion shape resonance for molecular nitrogen.

12733 **(DOE/ER/10881—T1) Dynamic aspects of the dye-sensitized photoconductivity of semiconductors. Technical progress report, April 1, 1981-March 31, 1983.** Goncalves, A.M.P. (Temple Univ., Philadelphia, PA (USA)). 1982. Contract AC02-81ER10881. 20p. NTIS, PC A02/MF A01. Order Number DE83003909.

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Research efforts have followed two parallel lines. First, fluorescence lifetime measurements on dye monolayers adsorbed on semiconductor and insulator surfaces, aimed at exploring processes which compete with injection. Second, construction of a fast transient absorption/gain spectrometer, to be used in measurements of the time evolution of surface oxidized dyes to probe the competition between recombination and escape. The fluorescence from rhodamine B and eosin molecules adsorbed on semiconductor (tin oxide and indium oxide) surfaces was monitored. The fluorescence decay curves yielded lifetimes in the range 50 to 60 ps, with an estimated 10 ps error limit in either direction. This corresponds to a lifetime nearly two order of magnitude shorter than in solution. Similar experiments were done with the same two dyes adsorbed on plain glass and on synthetic quartz. The fluorescence lifetimes were even shorter on these materials. The short fluorescence lifetimes of the dyes on both types of materials are most likely the result of effective energy transfer followed by quenching of the excitation at nonfluorescent impurities or defects such as dye aggregates. The conclusion that injection occurs with considerably less than unity efficiency has direct implication for current models of the low overall efficiencies of cells based on these dye/semiconductor systems.

12734 **(DOE/ER/12064—1) Drift mobilities by time-of-flight methods and time-dependent phototransport in the nanosecond regime in amorphous semiconductors.** Kirby, P.B.; Paul, W. (Harvard Univ., Cambridge, MA (USA)). Dec 1982. Contract AC02-82ER12064. 21p. NTIS, PC A02/MF A01. Order Number DE83004523.

Transport and recombination have been studied in samples of hydrogenated amorphous silicon through measurements of photocurrent transients in the nanosecond to millisecond time regimes. Both sample configurations suitable for time-of-flight measurements and configurations appropriate for the usual photoconductivity measurements have been employed. In principle, analysis of the experiments together permits the separation of current decreases with time caused by time-dependent mobilities from those caused by carrier loss due to deep trapping. The former involves carrier trapping which is temporary on the time scale of the experiment; the latter, trapping which removes carriers permanently, on the same time scale. The occurrence of the latter carrier loss is checked through integration of the current transient to obtain the total collected charge, with the applied electric field as a parameter.

12735 (INIS-mf—7220, pp 35) **Effect of neutron irradiation on the critical temperature of Nb_3Ge.** Sebek, J.; Stehno, J. (Ceskoslovenska Akademie Ved, Prague. Fyzikalni Ustav:. [nd]. (In Czech). NTIS (US Sales Only), PC A03/MF A01.

From 6. conference of Czechoslovak physicists; Ostrava, Czechoslovakia (27 Aug 1979).

12736 (INIS-mf—7409, pp 36) **Melting of two-dimensional argon film on graphite. A continuous melting.** Bohr, J. (Risoe National Lab., Roskilde (Denmark)). 1982. (In Danish). NTIS (US Sales Only), PC A03/MF A01.

From 18. Danish crystallographic meeting; Roskilde, Denmark (17 May 1982).

12737 (IS-T—963) **Nonphotochemical hole burning and the nature of amorphous solids.** Stout, R.P. (Ames Lab., IA (USA)). Jan 1982. Contract W-7405-ENG-82. 145p. NTIS, PC A07/MF A01. Order Number DE83004982.

Thesis.

Nonphotochemical hole burning in the absorption spectra of impurity molecules dissolved in amorphous solids has been studied for several impurity-host systems. These systems are divided into four classes according to holeburning occurrence and hole shape. The hole formation mechanism and possible expanations for each class of holes are discussed. Hole burning of tetracene in 3:2:2 glycerol/dimethylsulfoxide/N,N-dimethylformamide was studied as a function of burn temperature (T/sub B/), and annealing (hole disappearance) was studied for T > T/sub B/. Hole widths show that the pure dephasing of the impurity electronic state is orders of magnitude faster than found in crystalline media. This anomalously fast dephasing is explained by a theory considering the excited impurity to interact with two level systems (TLSs) is the host solid which undergo rapid phonon assisted tunneling transitions involving very low frequency phonons. The high temperature limit, where the dephasing frequency is linear in T, occurs in this theory for T ≦ 1K, proving an estimate of the width of the distribution function f(ϵ), where ϵ denotes the TLS asymmetry. The relationship between this theory and similar theories for TLS dephasing of fluorescence transitions of rare earth ions in inorganic glasses is discussed. A new theory is developed to explain the annealing process. The TLS barrier height is allowed to vary with the order parameter of an order-disorder transition assumed to be characteristic of amorphous solids. A constant distribution of critical temperatures based on the degree of local ordering of the host solid gives a linear intensity decrease with annealing temperature as observed for thermally activated barrier crossings. This theory is shown to be consistent with the hole formation and dephasing theories and all existing data.

12738 (IS-T—1018) **Superconductivity and low-temperature phases of Cu/sub x/Mo_6Se_8.** Doughterty, R.P. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 53p. NTIS, PC A04/MF A01. Order Number DE83004978.

Portions of document are illegible. Thesis.

At room temperature, rhombohedral Cu/sub x/Mo_6Se_8 can exist for 0.0 ≦ x ≦ 3.0, but only samples with 1.0 ≦ x ≦ 2.8 were stabilized in the present investigation. Two phases with narrow homogeneity ranges of x form at low temperatures by distortion of the rhomohedral lattice: $Cu_{2.0}Mo_6Se_8$ forms at 166°K and has T/sub c/ = 1.1°K; Cu/sub approx. 3.0/Mo_6Se_8 forms at 119°K and has T/sub c/ = 2.79°K. The equilibrium Cu concentrations of the low temperature phases increase with hydrostatic pressure. This gives rise to pressure-induced phase transitions, which were detected by measuring T as a function of pressure for several values of x. A pressure-composition phase diagram is given in Figure 17. The phase diagrams of Cu/sub x/Mo_6S_8 are qualitatively similar to those of Cu/sub x/Mo_6Se_8. The difference between the room temperature phase limits of the two systems is due to the lower valence of Se compared with S. 20 figures.

12739 (IS-T—1019) **Magnetic-resonance studies of reactively sputtered amorphous silicon-hydrogen alloys.** Lowry, M.E. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 231p. NTIS, PC A11/MF A01. Order Number DE83004958.

Thesis.

Proton magnetic resonance and EPR data are presented for several reactively sputtered amorphous silicon-hydrogen alloys and for a few amorphous silicon-hydrogen-deuterium alloys. Proton NMR absorption measurements are interpreted as evidence for significant inhomogeneity in the local hydrogen density: there is a phase of the material, in which the hydrogen bonded to Si is randomly distributed with average local density 3.39×10^{21} cm^{-3}; there is a hydrogen cluster defect with average local hydrogen density 4.34×10^{22} cm^{-3}; in the lower hydrogen concentration samples there is a third phase of the material which has no H. Proton NMR spin-lattice relaxation measurements as a function of both temperature and H concentration have been interpreted. The mechanism of spin-lattice relaxation in both cases involves spin diffusion to relaxation centers. In the low H concentration samples the relaxation centers are dangling bond electrons, while the centers in the high H samples appear to be three-center Si-H-Si bonds. EPR measurements on the dangling bond electrons are consistent with all of the above conclusions. A new very broad (approx. .1 Tesla) resonance has been detected in all of the samples and is tentatively interpreted in support of the existence of three-center bonds. 33 figures.

12740 (ONWI—342) **Petrographic examination of several four-year-old laboratory developed grout mixtures.** Rhoderick, J.E.; Buck, A.D. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Structures Lab.). Sep 1981. Contract AC06-76RL01830. 22p. (USAE-WES-C—78-1). NTIS, PC A02/MF A01. Order Number DE83004364.

Five different grout mixtures that were approximately 4 years old were examined by x-ray diffraction and SEM. Variables between the mixtures included type of cement, presence or absence of a natural pozzolan, and presence of salt in two of the mixtures. Specimens from each mixture were stored dry at ambient laboratory temperature while companion specimens were stored in simulated brine groundwater, also at about 73°F. The following conclusions were made: most of both wet and dry storage specimens showed cracking for all five mixtures. This was attributed to moisture or temperature changes or both in the laboratory environment; specimens from all mixtures made with salt or stored in the simulted brine groundwater showed conversion of ettringite to $C_3A(CaCl_2)H_{10}$; the use of portland rather than shrinkage-compensating cement or shrinkage compensating plus expansive cement was not usually detectable, probably because of the ettringite conversion in the presence of salt; the use of a natural pozzolan in one grout mixture was not detectable; and the phase composition and microstructure of the grout mixtures was normal for the materials involved, ages, and storage conditions.

12741 (SAND—82-1847C) **Doping and transport studies in In/sub x/Ga_x/sub 1-x/As/GaAs strained-layer superlattices.** Fritz, I.J.; Dawson, L.R.; Zipperian, T.E. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 15p. (CONF-821219—1). NTIS, PC A02/MF A01. Order Number DE83003915.

From International conference on metastable and modulated semiconductor structures; Pasadena, CA, USA (6 Dec 1982).

High-quality In/sub x/Ga/sub 1-x/As/GaAs strained-layer superlattices (SLS's), with 0.11 ≦ x ≦ 0.20, have been grown by molecular-beam epitaxy. The test structures grown include the first doped material in this SLS system, with Si being used for n-type doping and Be for p-type. A number of structures with up to 80 superlattice periods and with layer thicknesses in the 40 to 140 A range have been characterized by x-ray diffraction and optical techniques. Doped specimens have been characterized by C-V profiling and, for diode structures, by I-V, four-terminal resistivity, and Hall-effect measurements. Hall mobilities (parallel to the layers) are comparable to those of high-quality bulk alloy material, further evidence of the high crystalline quality possible in multilayer structures with thin, highly-mismatched (> 1%) layers. 5 figures.

12742 (UCRL—88334) Division of Materials Science (DMS) meeting presentation. Cline, C.F.; Weber, M.J. (Lawrence Livermore National Lab., CA (USA)). 8 Nov 1982. Contract W-7405-ENG-48. 16p. (CONF-821120—1). NTIS, PC A02/MF A01. Order Number DE83004318.

From Conference on material preparation and characterization capabilities; Oak Ridge, TN, USA (16 Nov 1982).

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Materials preparation techniques are listed. Materials preparation capabilities are discussed for making BeF_2 glasses and other materials. Materials characterization techniques are listed. (DLC)

12743 (ZfI-Mitt—43b) Proceedings of the 2. Working Meeting on Radiation Interaction. Selected papers - part 2. Brede, O.; Mehnert, R. (eds.). (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Sep 1981. 253p. (CONF-8009281—Pt.2). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83780130.

From 2. working meeting on radiation interaction; Leipzig, F.R. Germany (22 Sep 1980).

A separate abstract was prepared for each item in scope for the Energy Data Base. (HDR)

12744 New class of saturable absorbers at 10.6 μm based on doped alkali halides. Ahrenkiel, R.K. (Los Alamos Scientific Lab., NM); Dunlavy, D.J.; Sievers, A.J. *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-16**: No. 2, 225-230(Feb 1980).

A new class of saturable absorbers for 10.6 μm CO_2 laser wavelengths, using alkali halides doped with the perrhenate (ReO_4) ion. Here the ν_3 vibrational transitional saturates like an ideal two-level system owing to a large anharmonic interaction with the crystalline system. Fourier transform and saturation spectroscopy indicate a phonon scattering interaction and homogenous line broadening at temperatures above 80 K. Multiline saturable absorption at various laser wavelengths can be obtained by either crystal heating or by double doping. Laser applications indicate pulse compression and passive mode locking.

40 CHEMISTRY

REFER ALSO TO CITATION(S) 13535

12745 (INIS-SU—126) Petroleum chemistry and petroleum processing. Chemical problems of gas and oil production. Core chemistry and technology of synthetic liquid fuel. V. 4. (AN SSSR, Moscow). 1981. 269p. (In Russian). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83780192.

From 12. Mendeleev's congress on general and applied chemistry; Moscow, USSR (1981).

Selected papers are indexed separately.

12746 (TVA/PUB—83/12) Particle-size requirements for bulk blend materials. Circular Z-146. Hoffmeister, G. (National Fertilizer Development Center, Muscle Shoals, AL (USA)). 1982. 30p. (CONF-8208105—1). NTIS, PC A03/MF A01. Order Number DE83900922.

From 36. annual meeting of the Association of American Plant Food Control officials; Columbus, OH, USA (3 Aug 1982).

To provide bulk blenders with size-compatible granular materials and thus reduce segregation problems, it is desirable that producers of the materials be provided with a uniform particle-size distribution model at which to aim their production. A reasonable and somewhat recognized model is the average particle-size distribution found for DAP in the 1972 industry survey of The Fertilizer Institute Product Quality Committee. For reasonable adherence to this model, a material should be sized at least within the limits of the 6- to 16-mesh Tyler screens and should contain plus 8-mesh material to the extent of 25 to 45%. Materials matched to this extent would have Size Guide Numbers, by the CFI system, in the range of about 190 to 235. Satisfactory blends can be made outside this range, provided a reasonable matching of Size Guide Numbers is provided.

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 11670, 11677, 11678, 11691, 11691, 11900, 11919, 11933, 11939, 11940, 12798, 12801, 12803, 12949, 13084, 13085, 13086

12747 (BDX—613-2865) Applications of ion chromatography. Smith, R.E. (Bendix Corp., Kansas City, MO (USA)). Jan 1983. Contract AC04-76DP00613. 18p. NTIS, PC A02/MF A01. Order Number DE83004942.

A broad working knowledge of the principles of ion chromatography (IC) has been achieved. The capabilities of the ion chromatograph used have been established. Analytical methods have been developed. They include: (1) determination of fluoroboric acid in boron powders; (2) determination of ammonia in Ablefoam; (3) determination of chloride in chlorinated organic solvents; (4) determination of chloride in gold dequest solutions; (5) determination of chloride in sulfuric acid plating baths and in sodium hydroxide; (6) determination of tartarate, acetate, and formate in aluminum anodizing baths; and (7) elemental analysis of organic compounds and polymers by Parr Bomb combustion followed by IC. 5 figures, 3 tables.

12748 (BNL—32132) Analysis of gas purification by heatless adsorption. Knaebel, K.S.; Hill, F.B. (Ohio State Univ., Columbus (USA). Dept. of Chemical Engineering; Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 29p. (CONF-821106—22). NTIS, PC A03/MF A01. Order Number DE83003965.

From Annual meeting of heat transfer and energy conversion; Los Angeles, CA, USA (14 Nov 1982).

The heatless adsorption process was analyzed as a process for the purification of the light component of a binary feed of arbitrary composition. Local equilibrium with linear, uncoupled isotherms was assumed. The results of the analysis showed that a critical pressure ratio must be exceeded before complete purification is possible and that this pressure ratio increases as the light component content of the feed decreases. When clean-up of the light component is complete, pressurization with product leads to higher light component recoveries than pressurization with feed. This difference becomes large at small separation factors, small light-component feed contents, and large pressure ratios.

12749 (BNL—32212) Physical basis for prompt-neutron activation analysis. Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 35p. (CONF-821103—52). NTIS, PC A03/MF A01. Order Number DE83003938.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

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The technique called prompt γ-ray neutron activation analysis has been applied to rapid materials analysis. The radiation following the neutron radiation capture is prompt in the sense that the nuclear decay time is on the order of 10^{-15} second, and thus the technique is not strictly activation, but should be called radiation neutron capture spectroscopy or neutron capture γ-ray spectroscopy. This paper reviews the following: sources and detectors, theory of radiative capture, nonstatistical capture, giant dipole resonance, fast neutron capture, and thermal neutron capture γ-ray spectra. 14 figures.

12750 (DOE/PC/40809—T4) Separation of asphaltenes using high-resolution supercritical-fluid chromatography. Progress report, September 1-November 30, 1982. Jackson, W.P.; Fjeldsted, J.C.; Richter, B.E.; Campbell, R.W.; Lee, M.L. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry). 1982. Contract FG22-81PC40809. 27p. NTIS, PC A03/MF A01. Order Number DE83004017.

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Progress was made in three areas during the period of September through November. The para-tolyl phase reported on briefly in the previous quarterly report was more extensively developed and evaluated. Carbon dioxide and nitrous oxide were examined as mobile phases in connection with the development of the ionization-detector supercritical-fluid chromatography (SFC) system. Hy-

drocarbons, heterocyclic aromatics, and thermally labile free-radical initiators were all successfully chromatographed at near ambient temperatures. Some modifications to the static-coating procedure yielded more reproducible, efficient columns and evaluation of the effects of SFC conditions on crosslinked phases yielded some new insights into the necessary criteria for SFC stationary phases and cross-linking procedures. 13 figures, 2 tables.

12751 **(DOE/PC/41766—T1) High performance liquid chromatographic group-type analysis of the product of Fischer-Tropsch synthesis. Final report.** Feldman, J.A. (Duquesne Univ., Pittsburgh, PA (USA)). 12 Jan 1983. Contract FG22-81PC41766. 19p. NTIS (US Sales Only). Order Number DE83005482.

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Early in this study the unique properties of the Fluorinerts as HPLC eluting solvents became evident. This made it necessary to study behavior of detector response as a function of analyte concentration, the miscibility of different solvents with the fluorinerts, and the solubility of paraffin, olefinic, and Fischer-Tropsch products in the Fluorinerts. Along with these factors, column behavior as a function of preconditioning or activation and particle size had to be evaluated. As most of the interest appeared to be focused in knowing the amount and distribution of the normal paraffins and the terminal olefins, standards using paraffin mixtures from C_9-C_{15} and olefinic mixtures consisting of members from C_9-C_{14} were used. When Fischer-Tropsch product samples were employed, it became quite evident that compounds eluting well beyond the retention time for the C_{15} hydrocarbon were present. As information relative to the presence of oxygenated compounds, their possible class or whether aromatic compounds were also present, was lacking, no attempt was made to identify the unknown compounds. The investigations showed that it is possible to separate terminal olefins from normal paraffins provided there is no more than a six carbon difference in chain length using two activated silica columns containing five or six micron packings. One can avoid Schlieren effects by using sufficiently small amounts of analyte. The use of non-mixed solvent systems aid in consistent baselines. Quantitation is achievable within a 10% relative error under optimum separating conditions. 7 figures, 4 tables.

12752 **(DP-MS—82-76) Isotope-dilution analyses of the metallic elements.** Chastagner, P. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 31p. NTIS, PC A03/MF A01. Order Number DE83004924.

The isotope-dilution mass spectroscopy (IDMS) technique has proven to be to be a reliable, versatile analytical tool. Its applications seem to be limited only by the ingenuity of the investigator. Among its advantages are: small sample size; general applicability; precision and accuracy; dynamic range; simplified chemistry; determination is fixed at the time and place of isotopic homogenization. The last listed item is especially important for nuclear safeguards and processes where inventories are critical. IDMS is now a routine analytical technique in geochemical and nuclear laboratories, and in many environmental laboratories. Microgram and nanogram samples are normally used, frequently with automatic mass spectrometers, in many of these routine applications. More advanced techniques permit picogram and sub picogram samples to be analyzed, and spike to sample ratios can range from 1:1 to $1:10^{12}$ with detection limits at attogram levels for some elements. 3 figures, 3 tables.

12753 **(INIS-mf—7501) VOREM 80. Conference proceedings.** (Ceskoslovenska Vedeckotechnicka Spolecnost, Brno. Dum Techniky). 1980. 123p. (In Czech). (CONF-8010312—). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83780119.

From VOREM 80 conference; Brno, Czechoslovakia (30 Oct 1980).

Individual items in scope for the data base are processed separately. (DLC)

12754 **(IS-T—965) Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy.** Rice, G.W. (Ames Lab., IA (USA)). Jan 1982. Contract W-7405-ENG-82. 134p. NTIS, PC A07/MF A01. Order Number DE83004985.

Thesis.

An atmospheric pressure active nitrogen (APAN) afterglow was generated in pure flowing nitrogen (< 10 ppM O_2) excited in an electrodeless ozonizer discharge. The afterglow, which contains several metastable species, has been observed to be an efficient source for the excitation of atomic and molecular emission. The application of the APAN afterglow for the detection and determination of trace levels of Hg and the volatile hydride forming elements, As, Bi, Ge, Pb, Sb, Se, Sn, and Te is documented. The analytical potential of utilizing molecular emission observed from gaseous Cl, Br, I, B, S, and P compounds was evaluated. The APAN afterglow has also been evaluated as a selective detector for gas chromatography (GC). Selective detection for organo-Hg, Pb, and Sn species at trace levels has been achieved. The GC-APAN system has also been observed to be a nonselective detector for organic molecules at nanogram levels through the detection of CN ($B^2\Sigma^+$) emission at 388.3 nm. The GC-APAN system was specifically applied for the determination of ultratrace levels of methylmercury in fish, water, urine, and sediments, and diorganomercury compounds in water. The origin of the reactive species present in the afterglow and the possible interactions which result in emission from species introduced into the afterglow are discussed. Objectives for future research are also considered. 33 figures, 15 tables.

12755 **(IS-T—988) Fluorescence-line-narrowing spectrometry of polycyclic aromatic hydrocarbons in organic glasses.** Brown, J.C. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 247p. NTIS, PC A11/MF A01. Order Number DE83004960.

Portions of document are illegible. Thesis. Submitted to Iowa State Univ., Ames.

Fluoresence line narrowing spectrometry (FLNS), also known as optical site selection spectroscopy, is a relatively new technique holding great promise as an analytical tool. Species specific analysis of complex samples for low concentrations of polycyclic aromatic hydrocarbons (PAHs) is a difficult analytical problem. The PAH analysis problem is reviewed herein as are the mechanisms and characteristics of FLNS which make this new methodology appear ideal for application to the problem. Organic glasses are presented as the cryogenic matrices of choice for analytical FLNS. An experimental arrangement utilizing sensitive gated signal detection is used to test the analytical utility of FLNS. Data presented show that linear quantitative response from concentrations between saturation (about 1 ppM) and the low parts per trillion range is obtained. The demonstrated high precision and linearity of response show that routine analytical FLNS using organic glass matrices need not use internal standard and/or standard addition quantitation schemes. Unambiguous determinations of compounds in complex samples are shown to be expected. This expectation is shown to be realistic by demonstrating, in successive chapters: the unique FLNS behavior of each of 27 polycyclic aromatic compounds tested; resolution of the 13 fluorescing species in a 14 component artificial mixture; and determination of pyrene, 1-alkylpyrene, benzo(e)pyrene, anthracene, benzo(a)pyrene, benzo(k)fluoranthene, and perylene in an unseparated sample of SRC-II coal liquification product. (51 figures, 4 tables.)

12756 **(IS-T—994) Laser-excited atomic-fluorescence spectrometery as a tool for chemical analysis.** Goff, D.A. (Ames Lab., IA (USA)). Jan 1982. Contract W-7405-ENG-82. 142p. NTIS, PC A07/MF A01. Order Number DE83004984.

Thesis. Submitted to Iowa State Univ., Ames.

Laser excitation of atomic fluorescence overcomes several problems encountered when doing trace elemental analysis by atomic fluorescence spectrometry (AFS). One major problem encountered in AFS is light scattering, which may ultimately determine the minimum detectable atomic concentration. An atomic fluorescence spectrometer based on a wavelength-modulated continuous-wave dye laser is shown to diminish the light scattering signal and extend the minimum detectable concentration well beyond that

obtained by using a mechanical chopper for the determination of Ba in a premixed flame. A pulsed frequency-doubled dye laser was used to investigate the potential of the inductively coupled plasma (ICP) as an atomic reservoir for AFS. The laser was used to obtain spatial profiles of the AFS signal from iron in the extended tail plume of an ICP. The limit of detection for iron in the ICP is comparable to that obtained in a conventional flame, but the ICP offers the significant advantage of relative freedom from matrix problems. The excitation of atomic fluorescence by lasers that are not in resonance with the atomic transition is also studied for the cases of sodium and nickel. This off-resonant excitation opens the possibility of multielement analysis by laser excited atomic fluorescence spectrometry.

12757 **(IS-T—1023) New analytical techniques for mycotoxins in complex organic matrices.** Bicking, M.K.L. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 169p. NTIS, PC A08/MF A01. Order Number DE83004965.

Portions of document are illegible. Thesis.

Air samples are collected for analysis from the Ames Solid Waste Recovery System. The high level of airborne fungi within the processing area is of concern due to the possible presence of toxic mycotoxins, and carcinogenic fungal metabolites. An analytical method has been developed to determine the concentration of aflatoxins B1, B2, G1, and G2 in the air of the plant which produces Refuse Derived Fuel (RDF). After extraction with methanol, some components in the matrix are precipitated by dissolving the sample in 30% acetonitrile/chloroform. An aliquot of this solution is injected onto a Styragel column where the sample components undergo simultaneous size exclusion and reverse phase partitioning. Additional studies have provided a more thorough understanding of solvent related non-exclusion effects on size exclusion gels. The Styragel column appears to have a useable lifetime of more than six months. After elution from Styragel, the sample is diverted to a second column containing Florisil which has been modified with oxalic acid and deactivated with water. Aflatoxins are eluted with 5% water/acetone. After removal of this solvent, the sample is dissolved in 150 μL of a spotting solvent and the entire sample applied to a thin layer chromatography (TLC) plate using a unique sample applicator developed here. The aflatoxins on the TLC plate are analyzed by laser fluorescence. A detection limit of 10 pg is possible for aflatoxin standards using a nitrogen laser as the excitation source. Sample concentrations are determined by comparing with an internal standard, a specially synthesized aflatoxin derivative. In two separate RDF samples, aflatoxin B1 was found at levels of 6.5 and 17.0 ppB. The analytical method has also proven useful in the analysis of contaminated corn and peanut meal samples. 42 figures, 8 tables.

12758 **(IS-T—1048) Laser excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons.** Yang, Y. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 133p. NTIS, PC A07/MF A01. Order Number DE83004790.

Thesis.

Laser excited Shpol'skii spectroscopy (LESS) was developed as an analytical technique for the qualitative and quantitative determination of polynuclear aromatic hydrocarbons (PAHs) in complex mixtures. An excimer laser pumped, dye-laser coupled with gated detection was employed in the LESS system. The sharp absorption bandwidth exhibited by PAHs in Shpol'skii hosts (n-alkanes) at 15 K facilitated the selective excitation and sensitive detection of the luminescence through narrow band laser excitation. It was shown that LESS is capable of distinguishing between structural isomers as well as alkyated substitutional isomers when these occurred in complex mixtures. Luminescence spectra, site population dependency on concentrations, analytical curves, and detection limits were studied. It was found that: (a) reproducible site population of PAHs at concentration levels below one ppM could be achieved through reproducible cooling regimes; (b) self-absorption of the 0-0 fluorescence lines could be alleviated on excitation with reduced laser power; (c) analytical calibration curves were linear over 3.5 decades in concentration; and (d) detection limits were on the order of parts-per-trillion. The applications of LESS to the direct qualitative and quantitative determination of PAHs in various liquid fuel samples were demonstrated. Quantitative data obtained via standard addition and internal reference approaches showed excellent agreement. 30 figures, 9 tables.

12759 **(ORNL—5915) Multicomponent separations using a continuous annular chromatograph.** Begovich, J.M. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 284p. NTIS, PC A13/MF A01. Order Number DE83004690.

Multicomponent liquid chromatographic separations have been achieved by using a slowly rotating annular bed of sorbent material. By continuously introducing the feed material to be separated at a stationary point at the top of the bed and eluent everywhere else around the annulus, elution chromatography occurs. The rotation rate of the sorbent bed causes the separated components to appear as helical bands, each of which has a characteristic, stationary exit point; hence, the separation process is truly continuous. The continuous separation of copper, nickel, and cobalt from an ammoniacal leach liquor has been used to evaluate the behavior and capabilities of a variety of continuous annular chromatographs (CACs). The experimental units ranged in diameter from 89 to 445 mm and in annulus width from 6 to 51 mm. The effects of feed rate, feed concentration, rotation rate, eluent and eluent velocity, and column size were experimentally determined and modeled to show how they affect the performance of a CAC system. Use of the described models should allow confident design of new CAC units for performing continuous separations on a preparative scale. With its capability for continuously separating many components using one or a number of eluents, the CAC should make chromatography a competitive process in many industrial applications. 21 tables, 105 figures.

12760 **(PNL-SA—10560) Use of analytical electron microscopy and auger electron spectroscopy for evaluating materials.** Jones, R.H.; Bruemmer, S.M.; Thomas, M.T.; Baer, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 6p. (CONF-821103—54). NTIS, PC A02/MF A01. Order Number DE83003658.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Analytical electron microscopy (AEM) can be used to characterize the microstructure and microchemistry of materials over dimensions less than 10 nm while Auger electron spectroscopy (AES) can be used to characterize the chemical composition of surfaces and interfaces to a depth of less than 1 nm. Frequently, the information gained from both instruments can be coupled to give new insight into the behavior of materials. Examples of the use of AEM and AES to characterize segregation, sensitization and radiation damage are presented. A short description of the AEM and AES techniques are given.

12761 **(PUC-TN—03/81) Uranium content of petroleum by fission track technique.** Paschoa, A.S.; Mafra, O.Y.; Oliveira, C.A.N. de; Pinto, L.R. (Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Inst. de Fisica). Mar 1981. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703371.

The feasibility of the fission track registration technique to investigate the natural uranium concentration in petroleum is examined. The application of this technique to petroleum is briefly described and discussed critically. The results obtained so far indicate uranium concentrations in samples of Brazilian petroleum which are over the detection limit of fission track technique.

12762 **Leach rate measurements from SYNROC using neutron activation analysis.** Bates, J.K.; Steindler, M.J.; Sethi, V.K. (Argonne National Lab., IL (USA)). *Radiochemical and Radioanalytical Letters;* 53: No. 2, 95-102(23 Aug 1982).

Comparison of leach rates from the nuclear waste form SYNROC as determined by neutron activation analysis and by conventional spectroscopic techniques indicates that the activation process affects the leach rates. Leaching from activated samples is higher by up to seven times that observed for nonactivated samples, and suggests that another method be used to obtain the leach rates from SYNROC.

12763 **Paper prediction versus reality at the 1981 Modern Trends in Activation Analysis Conference.** Lyon, W.S. (Oak Ridge National Lab., TN (USA)). *Radiochemical and Radioanalytical Letters;* **52**: No. 6, 369-371(26 Jul 1982).

1 ref.

Comparison of predicted subject matter at the 1981 Modern Trends in Activation Analysis Conference with actual number of papers shows a fall off in environmental papers that is compensated for by increase in geological-forensic and materials-industrial contributions.

12764 **X-ray powder diffraction system for chemical specification of particulate aerosol samples.** Thompson, A.C.; Jaklevic, J.M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); O'Connor, B.H. (Western Australian Inst. of Tech., South Bentley. Dept. of Physics); Morris, C.M. (Los Alamos National Lab., NM (USA)). *Nuclear Instruments and Methods in Physics Research;* **198**: No. 2/3, 539-546(15 Jul 1982).

An X-ray powder diffraction system has been developed for the automated measurement and analysis of particulate aerosol samples. The system is optimized to process samples with particle loadings of about 100 $\mu g/cm^2$ which are acquired with dichotomous air samplers. A position-sensitive pressurized gas proportional chamber is used as the X-ray detector. This detector acquired information simultaneously over an angular range of up to seven degrees and increases the data acquisition rate by over twenty times compared to a conventional system. The use of a position-sensitive detector also reduces spectral artifacts resulting from preferred particle orientations since each spectral point is measured at many goniometer settings. The on-line data analysis procedure begins with a background subtraction of the radiation scattered from the sample substrate. A spectral analysis routine then automatically finds peaks and fits them with an analytical function to determine their position and intensity. A search-match procedure is then used to determine the major chemical species present on each sample. Results from this powder diffraction analysis are then combined with an X-ray fluorescence measurement of the elemental concentration to give quantitative analysis of the major chemical compounds present on these environmental samples.

12765 **Simultaneous determination of antimony and chlorine in synthetic rubbers by 14 MeV neutron activation analysis.** Bild, R.W. (Sandia National Labs., Albuquerque, NM (USA)). *Journal of Radioanalytical Chemistry;* **72**: No. 1-2, 23-33(1982).

From 1981 international conference on modern trends in activation analysis; Toronto, Canada (15 - 19 Jun 1981).

A nondestructive method for the analysis of Sb and Cl in synthetic rubbers by 14 MeV neutron activation analysis has been developed and evaluated by comparisons with microanalytical and thermal neutron activation analysis results. The method is most precise when a rubber with known amounts of Sb and Cl is used as a standard. Samples containing 0.07 to 2.5 wt.% Sb and 2.5 to 15.9 wt.% Cl have been analyzed. The precision for the method is 10% or better. Antimony and Cl detection limits are 0.02 and 0.5 wt.%, respectively. Agreement among the three methods is excellent; the thermal activation analysis method is more precise and simpler to apply if only Sb needs to be determined in a sample.

12766 **Determination of uranium and thorium in semiconductor memory materials by high fluence neutron activation analysis.** Dyer, F.F.; Emery, J.F.; Northcutt, K.J. (Oak Ridge National Lab., TN (USA)); Scott, R.M. (International Business Machines Corp., Hopewell Junction, NY (USA). East Fishkill Lab.). *Journal of Radioanalytical Chemistry;* **72**: No. 1-2, 53-67(1982).

From 1981 international conference on modern trends in activation analysis; Toronto, Canada (15 - 19 Jun 1981).

Uranium and thorium were measured by absolute neutron activation analysis in high-purity materials used to manufacture semiconductor memories. The main thrust of the study concerned aluminium and aluminium alloys used as sources for thin film preparation, evaporated metal films, and samples from the Czochralski silicon crystal process. Average levels of U and Th were found for the source alloys to be approximately 65 and approximately 45 ppb, respectively. Levels of U and Th in silicon samples fell in the range of a few parts per trillion. Evaporated metal films contained about 1 ppb U and Th, but there is some question about these results due to the possibility of contamination.

12767 **Procedures for multielement analysis using high-flux fast-neutron activation.** Williams, R.E.; Hopke, P.K.; Meyer, R.A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). *Journal of Radioanalytical Chemistry;* **72**: No. 1-2, 183-194(1982).

From 1981 international conference on modern trends in activation analysis; Toronto, Canada (15 - 19 Jun 1981).

Improvements have been made in the rabbit system used for multielement fast-neutron activation analysis at the Lawrence Livermore National Laboratory Rotating Target Neutron Source, RTNS-I. Procedures have been developed for the analysis of 20-25 elements in samples with an inorganic matrix and 10-15 elements in biological samples, without the need for prohibitively expensive, long irradiations. Results are presented for the analysis of fly ash, orchard leaves, and bovine liver.

12768 **Analysis of standard reference materials by absolute INAA.** Heft, R.; Koszykowski, R. (Lawrence Livermore National Lab., CA (USA)). *Journal of Radioanalytical Chemistry;* **72**: No. 1-2, 245-261(1982).

From 1981 international conference on modern trends in activation analysis; Toronto, Canada (15 - 19 Jun 1981).

Three standard reference materials were analyzed by a method of absolute INAA. Two different light water pool-type reactors were used to produce equivalent analytical results even though the epithermal to thermal flux ratio in one reactor was higher than that in the other by a factor of two.

12769 **Activation of Tl, Pb and Bi by 10-160 MeV neutrons: possible application to the analysis of Bi.** Parekh, P.P. (Brookhaven National Lab., Upton, NY (USA)); Finston, H.L. (City Univ. of New York, NY (USA)). *Journal of Radioanalytical Chemistry;* **72**: No. 1-2, 365-376(1982).

From 1981 international conference on modern trends in activation analysis; Toronto, Canada (15 - 19 Jun 1981).

The medium energy intense neutrons (MEIN) available at the Brookhaven Chemistry Linac Irradiation Facility have an energy distribution up to approximately 160 MeV an effective neutron flux of approximately $1.3x10^{11}$ cm^{-2} s^{-1}. The present work explores the feasibility of using this facility for the analysis of Tl, Pb and Bi by activation with MEIN. The most sensitive reactions, from a practical standpoint, were found to be Tl (n,xn)^{200}Tl (x=4, 6), Pb(n,xn)sup(204m)Pb(x=0, 3, 4, 5) and ^{209}Bi(n,6n)^{204}Bi. The absolute sensitivities attainable with these reactions are 0.1, 0.05 and 0.08 μg of Tl, Pb and Bi respectively, for 1 h irradiation at $1.3x10^{11}$ n cm^{-2} s^{-1} with samples counted 2 h after the end of irradiation. The advantages of the method over thermal neutron activation analysis are that all three elements can be assayed at the sub-microgram concentration levels by γ-spectrometry with the help of a simple radiochemical purification and the analytical results can be verified by cross checking via the multiple (n,xn) reaction products. However, interference from Bi in the determination of Pb and from Pb and Bi in the determination of Tl limits its usefulness to the analysis of Bi.

12770 **Interference control in low-level ^{129}I analysis.** Brauer, F.P.; Strebin, R.S. Jr.; Fager, J.E.; Kaye, J.H. (Pacific Northwest Lab., Richland, WA (USA)). *Journal of Radioanalytical Chemistry;* **72**: No. 1-2, 501-514(1982).

From 1981 international conference on modern trends in activation analysis; Toronto, Canada (15 - 19 Jun 1981).

Neutron activation analysis for ^{129}I at levels close to the detection limit requires consideration of radionuclide and nuclear reaction interferences. Low-level gamma-ray spectrometer methods for detection and measurement of interferences have been developed. Procedures which control or eliminate potential ^{129}I measurement errors during pre-irradiation separation, neutron activation, post-irradiation separation, radiation counting and data analysis are needed.

12771 **Iodine-129 separation and determination by neutron activation analysis.** Bate, L.C.; Stokely, J.R. (Oak Ridge National Lab., TN (USA)). *Journal of Radioanalytical Chemistry;* **72**: No. 1-2, 557-570(1982).

From 1981 international conference on modern trends in activation analysis; Toronto, Canada (15 - 19 Jun 1981).

This paper describes a method for analysis of iodine-129 in fission product mixtures originating from fuel reprocessing studies and low-level wastes. The method utilizes conventional iodine valence adjustment and solvent extraction techniques to chemically separate iodine-129 from most fission products. The iodine-129 is determined by neutron irradiation and measurement of the 12.4 hour iodine-130 produced by the neutron capture reaction. Special techniques were devised for neutron irradiation of iodine-129 samples in the pneumatic tube irradiation facilities at the High Flux Isotope (HFIR) and Oak Ridge Research (ORR) Reactors. Chemically separated iodine-129 is adsorbed on an anion exchange resin column made from an irradiation container. The loaded resin is then irradiated in either of the pneumatic facilities to produce iodine-130. Sensitivity of the analysis with the HFIR facility (flux: $5x10^{14}$ n/cm^2/s) and a 100 second irradiation time is approximately 0.03 nanograms. Samples up to 250 ml in volume can be easily processed.

12772 **Correlation of petroleum component properties for caustic flooding.** Jang, L.K.; Sharma, M.M.; Chang, Y.I.; Chan, M.; Yen, T.F. (Univ. of Southern California, Los Angeles). *AIChE (American Institute of Chemical Engineers) Symposium Series;* **78**: No. 212, 97-104(1982). (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

A correlation between the chemical composition of petroleum and the surface activity of oil-alkaline water interface is made. The polar components in oil are responsible for the ultralow interfacial tension. The active acids consist of a variety of nonhomogeneous species, some of which are chemically bonded. Mineral acid treatment of crude oil and sequential activation using incremental alkaline concentration in the flood were proposed to make maximum utilization of active species in crudes. Sandpack core flooding results are presented.

12773 **(ORNL-tr—4870) Voltametric study of indigo red.** Salvado, V.; Sanz, F. Translated from *Anales de la Seccion de Ciencias del Colegio, Universitario de Gerona (Universidad Autonoma de Barcelona) ;* **5**: 217-222(1980). Contract W-7405-ENG-26. 12p. NTIS (US Sales Only). Order Number DE82022182.

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Even if both indigo red and methylene blue show a prewave adsorption, it has been observed in the following work that the reduction process on the electrode of the former is different than for the latter. The formation and the structure of the first molecular film on the electrode undergoes an alteration when it becomes compact and the changes in the molecular interactions make the reduction process more difficult. The presence of a non-reproducible voltametric peak in successive sweeping times could be indicative of the formation of a second adsorption film with a new reordering of the molecules. 3 tables.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 11598, 11645, 11646, 11652, 11960, 11970, 12668, 12719, 12802, 12807, 12808

12774 **(CONF-8110248—Absts.) Seventh North American meeting of the Catalysis Society.** (Engelhard Corp., Edison, NJ (USA). Engelhard Industries Div.). 1981. 181p. Engelhard Corp., Engelhard Industries Div., Research Dept., Edison, NJ.

From 7. North American meeting of the Catalysis Society; Boston, MA, USA (11 Oct 1981).

Abstracts of 91 papers presented at the Seventh North American Meeting of the Catalysis Society are presented. These abstracts are grouped under the following categories: surface science and catalyst characterization; coal conversion; oxide catalysis; surface science and kinetics; surface science-reactions on metal surfaces; carbon monoxide/hydrogen chemistry; zeolites; general papers; reaction engineering and catalyst deactivation. (ATT)

12775 **(DOE/ER/04447—152) Physical-chemical studies of transuranium elements. Progress report, April 1, 1982-March 31, 1983.** Peterson, J.R.; Haire, R.G. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1983. Contract AS05-76ER04447. 45p. NTIS, PC A03/MF A01. Order Number DE83004574.

Portions of document are illegible.

Progress is reported on the following topics: electrochemical and spectroscopic studies of less-stable higher oxidation states of transuranium elements in complexing aqueous media; spectroscopic and electrochemical studies of selected lanthanides and actinides in molten dimethyl sulfone; spectroelectronchemical studies of the Ce(IV)/Ce(III) couple in aqueous carbonate solutions; characterization of actinide orthophosphates by Raman and absorption spectrophotometries and by x-ray diffraction; relativistic multiple scattering calculations on transuranium element compounds; Raman spectroscopic studies of natural minerals containing the uranyl ion; and solution calorimetry of californium metal.

12776 **(DOE/ER/10485—T2) Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982.** Hercules, D.M. (Pittsburgh Univ., PA (USA)). Apr 1983. Contract AC02-79ER10485. 11p. NTIS, PC A02/MF A01. Order Number DE83005085.

The overall objective of this research was to characterize the binding of transition metals to catalytic supports, and to study speciation of these metals on supports. The accomplishments during this period fall into two categories. First, we have advanced the adapation of spectroscopic instrumentation for studying catalytic surfaces. Second, we have obtained interesting and valuable information about a variety of catalytic systems. One of the most interesting accomplishments was to demonstrate the utility of using the combination of x-ray Photoelectron Spectroscopy (ESCA), Low Energy Ion Scattering Spectroscopy (ISS) and Laser Raman Spectroscopy (LRS) to study catalytic surfaces. We have demonstrated the correlation between ESCA, EXAFS and Photoacoustic Spectroscopy (PAS) measurements on the same catalyst systems. We have been able to characterize nickel species on alumina and silica surfaces when the preparation method and nickel content of the catalysts are varied. Second, we have studied the nature of cobalt species on alumina and how these species are affected by the presence of molybdenum or zinc, or by sulfiding. Third, we have been able to study the species of molybdenum on an alumina catalyst and to determine how these species are changed by sulfiding, by the presence of cobalt or by being supported on titania. Fourth, we have studied tungsten on alumina and shown how the catalyst species for tungsten differ from those for molybdenum on the same support. Fifth, we have carried out an extensive study of photoacoustic measurements to determine the site symmetry of cobalt and nickel supported on alumina.

12777 (INIS-mf—7409, pp 36) **Structure of NdF_3.** Lebech, B. (Risoe National Lab., Roskilde (Denmark)); Nielsen, L.; Nevald, R. (Danmarks Tekniske Hoejskole, Lyngby); Hazell, R.G.; Krebs Larsen, F. (Aarhus Univ. (Denmark)). 1982. (In Danish). NTIS (US Sales Only), PC A03/MF A01.

From 18. Danish crystallographic meeting; Roskilde, Denmark (17 May 1982).

12778 (INIS-mf—7409, pp 36) **Structural transformation of YbH_3 induced by high pressure.** Staun Olsen, J.; Steenstrup, S. (Copenhagen Univ. (Denmark)); Buras, B.; Lebech, B. (Risoe National Lab., Roskilde (Denmark)); Gerward, L. (Danmarks Tekniske Hoejskole, Lyngby); Johansson, B. (Aarhus Univ. (Denmark)); Skriver, A. (Nordita, Copenhagen, Denmark). 1982. NTIS (US Sales Only), PC A03/MF A01.

From 18. Danish crystallographic meeting; Roskilde, Denmark (17 May 1982).

12779 (INIS-mf—7409, pp 36) **Structures of ytterbium-dihydride.** Lebech, B.; Hessel Andersen, N.; Schroeder Pedersen, A. (Risoe National Lab., Roskilde (Denmark)); Steenstrup, S. (Copenhagen Univ. (Denmark)). 1982. (In Danish). NTIS (US Sales Only), PC A03/MF A01.

From 18. Danish crystallographic meeting; Roskilde, Denmark (17 May 1982).

12780 (INIS-mf—7409, pp 36) **Neutron and X-ray diffraction on Nb_3Ge.** Joergensen, J.-E.; Rasmussen, S.E. (Aarhus Univ. (Denmark)). 1982. (In Danish). NTIS (US Sales Only), PC A03/MF A01.

From 18. Danish crystallographic meeting; Roskilde, Denmark (17 May 1982).

12781 (INIS-mf—7461) **Investigations on the structure and polymorphy of the dibromides of dysprosium, thulium, ytterbium and calcium.** Bossert, W. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemie). 12 Feb 1981. 89p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780182.

Thesis.

In the study of the temperature-dependent polymorphy of $TmBr_3$, $YbBr_3$ and $CaBr_3$ with the help of high-temperature GUINIER pictures and differential thermoanalysis, the following four modifications could be identified and their existence range determined for rare earth dibromides: SrJ_2-type, α-PbO_2 type, $CaCl_2$ type and rutile type. The $CaCl_2$ type only and the rutile type as high-temperature form were observed for $CaBr_2$. The crystal structures of individual modifications were determined using various compounds. The quantitative description of the phase transition of the second order of the $CaCl_2$ type to the rutile type taking the example of $CaBr_2$, as well as the detailed discussion of the geometrical relationships between the remaining polymorphous structures, show a clear picture of the polymorphic behaviour of $TmBr_3$, $YbBr_3$ and $CaBr_2$

12782 (INIS-SU—125, pp 524) $\nu\Lambda_7\mu\mu_{43}\Sigma_7\omega\ \mu\pi\Sigma_6{}^+{}_7\mu\ \Lambda_8\ \Lambda\omega^+{}_7\Omega\pi_3\pi^+\Lambda\Omega_3\gamma\ \pi\omega_3\Omega\mu^+\pi^+\Lambda\Omega\mu\ {}^+\Omega\ \mu\Sigma_4\mu\pi^+\pi\Sigma\pi_{76}\ {}_{87}\omega\omega^+\pi_7\ {}_{93}\omega\Omega_7\pi\mu\rightleftharpoons\ \cong\omega\pi_7\Delta'{}_7\Xi Y\ \sigma\rightleftharpoons\cong\rightleftharpoons\ \omega_{34}{}^+\beta\Lambda\Xi_3 Y\ {}_1\Sigma\rightleftharpoons\delta\rightleftharpoons\ <\mu^-{}_7\Omega\mu\beta^+\alpha Y\ \upsilon\rightleftharpoons\sigma\rightleftharpoons\ {}^{1982}\rightleftharpoons\ \leqq\kappa\Omega\ \}\Sigma\mu\mu^+{}_3\Omega\cong\rightleftharpoons\ \sigma\sqrt{\kappa}\int\ \leqq<\int\ \int_3\gamma_7\mu\ \xi\Omega\gamma\bullet\cong Y\ \approx\epsilon\ \cong^{25}\pounds\upsilon\delta\ \cong^{01}\rightleftharpoons$

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

12783 (IS-M—388) **Metal clusters and extended metal-metal bonding in metal oxide systems.** McCarley, R.E. (Ames Lab., IA (USA)). 1982. Contract W-7405-ENG-82. 19p. (CONF-8205114—2). NTIS, PC A02/MF A01. Order Number DE83003793.

From American Chemical Society symposium on inorganic chemistry; Bloomington, IN, USA (16 May 1982).

The results of recent investigations of the synthesis and structures of ternary and quaternary molybdenum oxide compounds having metal-metal bonded cluster units or infinite chains are presented. In all cases the average oxidation state of molybdenum is less than 4+, the lowest state previously known in structurally characterized oxide phases. New compounds containing discrete clusters are $LiZn_2Mo_3O_8$ and $Zn_3Mo_3O_8$, with triangular units, and $Ba_{1\ 14}Mo_8O_{16}$ with two variants of rhomboidal tetranuclear units, one having regular and the other distorted rhomboidal geometry. Infinite metal-metal bonded chains consisting of Mo_6 octahedral cluster units fused on opposite edges are found in the new compounds $NaMo_4O_8$, $Ba_5(Mo_4O_8)_8$, $Sc_{0\ 75}Zn_{1\ 25}Mo_4O_7$, $Ti_{0\ 5}Zn_{1\ 5}Mo_4O_7$. the effects of the differing metal-based electron counts in the repeat units of the infinite chains among these compounds are discussed with reference to metal-metal bond order and structural variations within the units. 7 figures, 4 tables.

12784 (IS-M—389) **Halide and chalcogenide clusters of the early transition metals.** McCarley, R.E. (Ames Lab., IA (USA)). 1982. Contract W-7405-ENG-82. 44p. (CONF-8205139—1). NTIS, PC A03/MF A01. Order Number DE83003792.

From Metal clusters in chemistry conference; London, UK (20 May 1982).

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New clusters and compounds with extended metal-metal bonding of the transition elements of Group VI have been discovered at a startling pace in the last ten years. Excluding the interesting variety of metal-metal bonded dimers, prior to 1970 the only discrete cluster compounds known were the trinuclear M_3X_{13} type first elucidated in the compound $Zn_2Mo_3O_8$ and derivatives based upon the $M_6X_8{}^{4+}$ metal halide units. Subsequently many new cluster types have been found with both halide and chalcogenide bridging ligands, and the number of metal atoms ranging from three to twelve in the discrete units. Still more recent work has demonstrated the stability of structures with infinite chains of metal-metal bonded repeat units consisting of metal octahedra sharing edges or faces. Such compounds offer characteristics of both the elemental metals from which they are formed and the more conventional isolated cluster species. In this paper, the most recent progress in these areas with emphasis on work conducted at the Ames Laboratory is summarized according to cluster size (nuclearity). These groupings are: trinuclear clusters; tetranuclear clusters; tetrahedral clusters; square planar and butterfly clusters; rectangular clusters; rhomboidal clusters; infinite chain compounds. 11 figures.

12785 (IS-T—959) **Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_3Mo_2Cl_8H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters.** Luly, M.H. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 122p. NTIS, PC A06/MF A01. Order Number DE83004971.

Thesis.

A black powder isolated from the reaction of $Cs_3Mo_2Cl_8H$ and zinc in refluxing pyridine, $Mo_{1\ 0}Cl_{1\ 1}py_{0\ 8}$, has been studied. The material is amorphous to x-rays, and the infrared spectrum indicates coordinated pyridine and chlorine. The x-ray photoelectron spectrum indicates one type of molybdenum and shows both terminal and bridging chlorine are present in the ratio of 1.5:1.0. $Mo_{1\ 0}Cl_{1\ 1}py_{0\ 8}$ is stable at elevated temperatures and can be heated in vacuo for over 24 hours at 300°C with little change in composition. The best description of this material seems to be a highly bridged, metal-metal bonded cluster or polymer. Mo_6Cl_{12} has been reacted with various sulfur-containing reagents to prepare mixed chlorine sulfide Mo_6X_8 clusters. These clusters have been characterized by x-ray powder diffraction, x-ray photoelectron spectroscopy, and infrared spectroscopy. High reaction temperatures (> 200°C) with high ratios of NaSH to Mo_6Cl_{12} (16:1) result in decomposition of the Mo_6X_8 cluster. Reactions of 1 equivalent of Mo_6Cl_{12} and 8 equivalents of NaSH at 115°C yield amorphous products. Intermediate conditions produce crystalline Mo_6X_8 derivatives. These products appear to be solid solutions, or have some amorphous impurity present. A FORTRAN IV computer program for analyzing x-ray photoelectron spectra is described. The program smooths the data, makes baseline and scattering corrections, and fits the corrected spectra with linear combinations of Gaussian and Cauchy functions. The results are useful in inferring structural information. 19 figures, 4 tables.

12786 (IS-T—964) **Kinetic studies of organocobalt compounds related to vitamin B_{12} coenzymes.** Gjerde, H.B. (Ames Lab., IA (USA)). Jan 1982. Contract W-7405-ENG-82. 123p. NTIS, PC A06/MF A01. Order Number DE83004864.

Thesis.

The decomposition of the unstable alkylcobaloxime, α-phenylethyl-(aquo)cobaloxime, proceeds rapidly in acidic, aqueous methanol leading to the formation of styrene and dimeric organic products. Kinetic studies were carried out at μ = 1.0 M in the [H^+] range 0.0014 to 1.0 M. The results obeyed the rate expression -d[$C_6H_5CH(CH_3)Co(dmgH)_2(OH_2)$]-/dt = (k/sub b/ + K/sub a/ K/sub H/[H^+]/1 + K/sub H/[H^+]) with k/sub b/ = (3.27 +- 0.21) x 10^{-3} s^{-1}, k/sub a/ + (1.48 +- 0.14) x 10^{-2} s^{-1}, and k/sub H/ = 8.13 +- 0.38 M^{-1} at 25.0°C. Activation parameters have been evaluated for k/sub b/ and k/sub a/. The rate of decomposition of α-phenylethyl(aquo)cobaloxime is independent of added oxidants, such as H_2O_2 and $Co(NH_3)_5Br^{2+}$. A mass law retardation

effect is observed in the presence of $Co(en)_3^{3+}$ in neutral solution. The kinetic and product anlaysis data are used to show that decomposition of α-phenylethyl(aquo)cobaloxime involves concurrent homolytic and β-elimination pathways in acidic media. Vitiman B/sub 12a/ has been generated electrochemically at pH 2.5 to 3.2 in aqueous glycine buffers to yield reasonably stable solutions under strictly oxygen-free conditions. The reaction of B/sub 12s/ and a series of chromium(III) complexes, $(H_2O)_5CrX^{2+}$ with X = F^-, Cl^-, Br^-, N_3^-, NCS^-, SH^-, and OH^-, occurs rapidly to produce B/sub 12r/ and Cr^{2+}. The kinetic results follow a second-order rate dxpression -d[B/sub 12s]/dt = k/sub x/[B/sub 12s][CrX^{2+}]. Electron transfer is proposed to occur by an innersphere mechanism. 22 figures, 17 tables.

12787 **(IS-T—1007) Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen.** Diaz-Bossio, L.M. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 113p. NTIS, PC A06/MF A01. Order Number DE83004963.

Thesis. Submitted to Iowa State Univ., Ames.

The reductive decomposition of calcium sulfate pellets with both hydrogen and carbon monoxide was studied experimentally in the range of 900 to 1100°C. The conditions of the reaction were controlled in order to enhance the formation of calcium oxide while the production of the undesirable calcium sulfide was inhibited; carbon dioxide was used to prevent calcium sulfide formation. Cylindrical calcium sulfate pellets were prepared at a constant compression pressure and reduction was carried out initially at a constant temperature and various reductant gas concentrations. Additional experiments were made with a constant gas phase concentration and various reaction temperatures. Stabilization of the pellet through heating prior to initiating the reduction process was required in order to obtain reliable data. Treatment of the pellet at elevated temperatures caused sintering which reduced the pellet surface area to a value that changed little with additional heating time. Conversions of about 100% were obtained in several hours with both reductant gases at temperatures around 1000°C and higher. The rate of calcium sulfate reduction with hydrogen was consistently found to be higher than that with carbon monoxide. The grain model was used to first determine the mechanism controlling the reduction process, then the grain shape factor was evaluated by fitting the data, and finally the parameters involved in the controlling mechanism were calculated. A first-order chemical reaction was found to be the predominant resistance limiting the rate of reduction. The highest correlation factors, around 0.99, were always obtained when a spherical grain shape factor was used in plotting the numerical solution of the governing equation. 42 figures, 3 tables.

12788 **(IS-T—1031) Kinetic and mechanistic studies of the reactions of selected aliphatic radicals with metal complexes and the decomposition of organoperoxy cobalt complexes.** Chen, J.T. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 151p. NTIS, PC A08/MF A01. Order Number DE83004865.

Thesis.

The reduction of $.C(CH_3)_2OH$ and $.CH(CH_3)OC_2H_5$ radicals by $V(H_2O)_6^{2+}$ forms the respective organic products, $(CH_3)_2CHOH$ and $(C_2H_5)_2O$ and the V^{3+} ion. The kinetics of these reactions were studied by a method of chemical competition using the homolytic decomposition of the corresponding organo(pentaaquo) chromium(III) complex. The rate constants are 2.1 x $10^5 M^{-1}S^{-1}$ for $.C(CH_3)_2OH$, which is found to be independent of $[H^+]$ and ionic strength, and 5.9 x 10^4 $M^{-1}S^{-1}$ for $.CH(CH_3)OC_2H_5$ at 25°C. The former reaction studied in 92% D_2O has k = 3.6 x 10^4 $M^{-1}S^{-1}$. The mechanism invoked is either (1) hydrogen atom abstraction by the radical from a vanadium-bound water molecule or (2) formation of a seven-coordinate organovanadium intermediate followed by its rate-limiting acidolysis. The rate constants of the reactions between the Co/sup II/([14]$aneN_4)^{2+}$ complex and the same aliphatic radicals were determined in the same manner, being 8.8 x 10^8 $M^{-1}S^{-1}$ for $.C(CH_3)_2OH$ and 1.7 x 10^8 $M^{-1}S^{-1}$ for $.CH(CH_3)OC_2H_5$ (at 25°C, 0.2M H^+, 0,5M ionic strength). These reactions are believed to occur by formation of an organocoblat transient which subsequently decomposes to yield $(CH_3)_2CO$ from $.C(CH_3)_2OH$, and CH_3CHO and C_2H_5OH from $.CH(CH_3)OC_2H_5$. Organoperoxycobaloximes are subject to decomposition in aqueous perchloric acid. The complexes examined are (1) ROOCr(dmgH)$_2$Py with R = 2-propyl, 2 butyl, cyclopentyl, benzyl and d_7-2-propyl and (2) $(CH_3)_2CHOOCo(dmgH)_2L$ with L = pyridine, piperidine, water and ammonia. Their decomposition leds to $H_2OCo(dmgH)_2L^+$ and a mixture of ketone and hydroperoxide. Kinetic studies were carried out at 25.0°C, μ = 1.0M in the $[H^+]$ range 0.010 to 0.98M. The disappearance of the organoperoxy complexes obeys a rate law.

12789 **(IS-T—1034) Kinetics and mechanisms of the reactions of aliphatic free radicals with organocobaloximes and fluoropentaamminecobalt(III) ion, and of iron(III) with methylrhodoxime.** McHatton, R.C. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 140p. NTIS, PC A07/MF A01. Order Number DE83004856.

Thesis.

Benzyl, methyl, ethyl, and isopropyl(aquo)cobaloximes, $RCo(dmgH)_2OH_2$, have been shown to undergo highly specific reactions in which a new carbon-carbon bond is formed in their reactions with aliphatic free radicals. Thus, benzylcobaloxime reacts with the $C(CH_3)_2OH$ radical to yield $PhCH_2C(CH_3)_2OH$ and Co/sup II/$(dmgH)_2OH_2$. With the exception of benzyl and meta-chlorophenyl radicals, this reaction appears quite general for aliphatic radicals. The kinetics of the reaction between the organocobaloximes and the $C(CH_3)_2OH$ and $CH(CH_3)OC_2H_5$ radicals have been determined by novel kinetic competition methods. The organocobaloximes undergo an acid-base equilibrium in which one of the O-H...O groups of the $(dmgH)_2$ pseudo-macrocycle is protonated. Both the protonated and unprotonated forms of the cobaloxime react, with K/sub obs/ at a fixed acid concentration related to the rate constants for the reaction of the protonated (k/sub a/) and unprotonated (k/sub b/) forms of the organocobaloxime by k/sub obs/ = k/sub b/ + k/sub a/K/sub H/$[H^+]$ divided by 1 + K/sub H/$[H^+]$. Rate constants for the radicals are provided. The data are interpreted in terms of an addition-elimination mechanism involving one of the dimethylglyoxime ligands of the organocobaloxime. The reduction of $Co(NH_3)_5F^{2+}$ by the $C(CH_3)_2OH$ and $CH(CH_3)OC_2H_5$ radicals has been studied by novel competition methods involving analysis of the fluoride ion produced in the reduction. The rate constants obtained at 25.0°C and 1.0M ionic strength are (2.2 +- 0.3) x 10^6 M^{-1} s^{-1} and (1.1 +- 0.2) x 10^6 M^{-1} s^{-1}, $C(CH_3)^2OH$ and $CH(CH_3)OC_2H_5$ radicals, respectively. 19 figures, 18 tables.

12790 **(IS-T—1035) Irreversible cooperative processes on lattices.** Burgess, D.R. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 194p. NTIS, PC A09/MF A01. Order Number DE83004795.

Thesis.

Kinetic models for irreversible cooperative processes on lattices are developed. Hierarchial rate equations for the probabilities of configurations of empty sites are discussed in detail and the concept of shielding is introduced. Several, exactly soluble, one-dimensional processes are treated including: (1) those incorporating a cooperative range of influence of one lattice vector beyond a fixed number of blocking sites; (2) filling in stages for highly repulsive interactions; (3) correlation functions; (4) configurational entropy of ring lattices; (5) processes with competing events; (6) periodic lattices; and (7) limited mobility. Approximate solution techniques for analyzing other one-dimensional processes are also discussed. A special irreversible kinetic process on a two-dimensional square lattice is also treated and a computer program is described which has been developed to generate the appropriate two-dimensional kinetic equations. The resultant equations are treated using various factorization/truncation schemes. A method is given to determine rate constants for irreversible polymer reactions from experimental measurements of the fraction of converted sites with time. Other aspects of irreversible polymer reactions are also treated. The chemisorption of nitrogen onto the (100) face of tungsten is discussed as an example of how irreversibility influences surface processes. A short discussion of irreversible three-dimensional processes in crystalline solids concludes the work.

12791 **(IS-T—1036) Synthesis and characterization of oxide interstitial derivatives of zirconium monochloride and monobromide.** Seaverson, L.M. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 97p. NTIS, PC A05/MF A01. Order Number DE83004861.

Thesis.

An investigation into the reactivity of ZrX (X = Br,Cl) found no evidence for successful intercalation of ZrCl between the chloride layers with NH_3, pyridine, CO, n-butyl lithium, Li/NH_3, K/NH_3, and Li; and Zr plus LiCl, CsCl, and NaCl. Reactions of ZrX + n ZrO_2 at 850 to 1000° for two weeks produced an expanded ZrX structure (ZrX(O/sub y)) and the metal phase Zr(O/sub x/)(X/sub p/) (p congruent to 0). Three ZrCl(O/sub y/) crystal structures were refined.

12792 **(LBL—15156) Thermodynamic properties of strongly nonideal fluid mixtures from an extended quasi-chemical theory.** Dimitrelis, D.; Prausnitz, J.M. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Chemical Engineering). Nov 1982. Contract AC03-76SF00098. 25p. (CONF-821106—21). NTIS, PC A02/MF A01. Order Number DE83004295.

From Annual meeting of heat transfer and energy conversion; Los Angeles, CA, USA (14 Nov 1982).

In his later years, E.A. Guggenheim recognized that the exchange energy in his quasi-chemical theory of mixtures is really a free energy. Proper use of quasi-chemical theory contains an entropic contribution which must also be considered in calculating deviations from random mixing. Methods for including this entropic contribution are discussed here. When Guggenheim's quasi-chemical theory is coupled with a two-fluid theory of mixtures and a suitable reference system, we obtain an equation of state that may be particularly useful for fluid mixtures showing large deviations from ideality.

12793 **(UCRL—83592) Extension of the Smith predictor.** Herget, C.J.; Frazer, J.W. (Lawrence Livermore National Lab., CA (USA)). 12 Nov 1979. Contract W-7405-ENG-48. 39p. (CONF-800805—3). NTIS, PC A03/MF A01. Order Number DE83005508.

From Joint automatic control conference; San Francisco, CA, USA (13 Aug 1980).

A procedure for designing controllers for nonlinear systems with time delays is presented in this paper. The method extends the technique used by O.J.M. Smith for linear systems to nonlinear systems. The extended method is well suited for digital control. As with the classical Smith predictor, this extended version reduces the design of a system with time delays to one without time delays. The proposed implementation permits controller design by state variable methods as well as classical procedures. Examples of both time optimum and proportional plus integral plus derivative (PID) control on an experimental enzyme reactor are included. In the examples, saturation of the control variable causes the system to be nonlinear.

12794 **Luminescence studies of lanthanide oxides. I. Thermal and hydration effects on the metal ion site symmetry in europium oxide catalysts.** Brittain, H.G. (Seton Hall Univ., South Orange, NJ); Perry, D.L. *Journal of Catalysis;* **77**: No. 1, 94-103(Sep 1982). Contract W-7405-ENG-48.

High-resolution luminescence spectroscopy has been used to study the site symmetry of Eu(III) ions in Eu_2O_3 prepared under conditions suitable for catalytic use. It was found that the Eu(III) site symmetry was a sensitive function of the pretreatment procedure, and it proved possible to determine the number of spectroscopically nonequivalent Eu(III) ions in the oxide material from an analysis of the fine structure within the emission bands. The site symmetry is altered primarily by thermal effects, and hydration of the oxide is not found to induce large changes in site symmetry.

12795 **Poly(tertiary phosphines and arsines). 18. Preparation and structure of bis{μ-[(methylamino)bis(dimethoxyphosphine)]}-bis(dicabonylcobalt), a binuclear complex with approximate square-pyramidal and trigonol-bipyramidal coordination of cobalt atoms in the same molecule.** Brown, G.M. (Oak Ridge National Lab., TN); Finholt, J.E.; King, R.B.; Bibber, J.W. *Inorganic Chemistry;* **21**: No. 6, 2139-2145(Jun 1982). Contract W-7405-ENG-26.

The preparation and the X-ray crystal-structure analysis of bis{μ-[(methylamino)bis-(dimethoxyphosphine)]}-bis(dicabonylcobalt), a binuclear cobalt carbonyl complex containing the ligand $CH_3N[P(OCH_3)_2]_2$ is described. A single-crystal X-ray diffraction study of this complex shows a structure with a cobalt-cobalt bond 2.498 angstrom long bridged by two $CH_3N[P(OCH_3)_2]_2$ ligands. The two cobalt atoms are both five-coordinate and have identical sets of ligands, each of the two being bonded to the other cobalt atom, to two carbonyl groups, and to two trivalent phosphorus donors. However, the two cobalt atoms are not equivalent; one has trigonal-bipyramidal coordination and the other has square-pyramidal coordination. The trigonal-bipyramidal cobalt atom has the other cobalt atom and a carbonyl group in the axial position. The square-pyramidal cobalt atom has a carbonyl group in the apical position. The difference in coordination of the two cobalt atoms probably results from the packing of a fluxional molecule which has a symmetrical average structure in solution. Although the ν(CO) frequencies in the infrared spectrum in solution all appear in the terminal region, the complex in the crystal contains a carbonyl group in a borderline semibridging position with Co-C distances of 1.756 and 2.812 angstrom, probably as the result of the crystal packing. The atoms of th $Co_2(CO)_4$ unit in the complex are essentially coplanar, and the least-squares best plane through these atoms is an approximate mirror plane for the molecule.

12796 **Metal-metal-bonded complexes of the early transition metals. 4. Synthesis and characterization of the tantalum (II) dimer $Ta_2Cl_6(PMe_3)_4$.** Sattelberger, A.P.; Wilson, R.J. Jr.; Huffman, J.C. (Univ. of Michigan, Ann Arbor). *Inorganic Chemistry;* **21**: No. 6, 2392-2396(Jun 1982). Contract FG02-80ER10125.

The dimeric tantalum(III) phosphine complex $Ta_2Cl_6(PMe_3)_4$ (1) has been prepared from the reaction of tantalum pentachloride, trimethylphosphine, and sodium amalgam in toluene. The compound crystallizes in the noncentrosymmetric orthorhombic space group $P2_12_12_1$ with a = 11,681 (3) angstroms, b = 11.834 (3) angstroms, C = 20.257 (7) angstroms, V = 2800.18 angstroms^3, and rho(calcd) = 2.085 g cm^{-3} for mol wt 878.9 and Z = 4. The structure refined to R/sub F/ = 0.037 and R/sub wF/ = 0.035. 1 is a distorted edge-sharing bioctahedral complex with axial phosphines on one tantalum and equatorial phosphines on the second. Direct P-P coupling is observed across the dimer with J/sub PP'/ = 2.46 Hz. The metal-metal bond length in 1 is 2.721 (1) angstroms, and the formal metal-metal bond order in this d^2-d^2 dimer is 2.

12797 **Preparation, reactivity, and stability of mixed-metal bimetallic complexes containing the pentacyanoferrate(II) moiety.** Pfenning, K.J.; Lee, L.; Wohlers, D.; Petersen, J.D. (Clemson Univ., SC). *Inorganic Chemistry;* **21**: No. 6, 2477-2482(Jun 1982). Contract AS09-80ER10671.

A series of mixed-metal bimetallic complexes of the type $(CN)_5Fe$/sup II/LM/sup III/L'$_s$, where L = 4-cyanopyridine, pyrazine, or 4,4'-bipyridine and M/sup III/L'$_s$ = Rh/sup III/$(NH_3)_5$ or Co/sup III/$(CN)_5$, have been prepared and characterized. These complexes are formed by the reaction $(CN)_5$ Fe/sup II/OH_2 + LM/sup III/L'$_s$ ← → $(CN)_5$Fe/sup II/LM/sup III/L'$_s$. The rate constant for dimer formation, k_3, is a factor of 10^3 smaller for M/sup III/ = Co(III) (~1 M^{-1} s^{-1}) than for Rh(III) (~10^3 M^{-1} s^{-1}). This is due to a charge effect in the formation of an outer-sphere encounter complex. The rate constants for bimetallic dissociation, K/sub -2/, are relatively insensitive (~10^{-3} s^{-1}) to the nature of the remote metal and indicate a dissociative decomposition. The formation constant of the bimetallic complex, K_3, parallels k_3 and is

larger for the LRh/sup III/$(NH_3)_5$ complexes than for LCo/sup III/$(CN)_5$ complexes bound to the $(CN)_5$Fe/sup II 3-/ fragment.

12798 Isotope effects in the infrared spectra of the metal carbonyl hydride/deuteride anions (H/D)M(CO)4p (M = Fe, Ru, or Os). Walker, H.W.; Ford, P.C. (Univ. of California, Santa Barbara). *Inorganic Chemistry;* **21**: No. 6, 2509-2510(Jun 1982). Contract AT03-76ER70262.

In the course of investigating the acid/base properties and possible catalysis roles of several metal carbonyl hydrides, we have prepared the deuteride complexes $DM(CO)_4^-$ of the iron triad (M = Fe, Ru, or Os) as the PPN^+ salts (PPN^+ = bis(triphenylphosphine)iminium). Comparison of the infrared spectra of these species to the spectra of the hydride analogues [PPN][$HMCO)_4$] demonstrates considerable isotope effects between the metal-hydrogen and carbon oxygen stretching vibrations. Although similar effects have been noted previously in certain other metal carbonyl hydride complexes, the present observations add emphasis to the necessity of considering such resonance interaction in force field calculations based on the vibrational spectra.

12799 An ESR study of olefin iron carbonyl radical anions. Krusic, P.J. (E.I. du Pont de Nemours and Company, Wilmington, DE); Filippo, J.S. Jr. *Journal of the American Chemical Society;* **104**: No. 9, 2645-2647(5 May 1982). Contract AS05-80ER10662.

Recently we reported an electron spin resonance study of a series of iron carbonyl radical anions Fe/sub n/(CO)/sub m/$^-$.(n = 2-4), which are formed in the reduction of Fe/sub n/$(CO)_5$ by alkali metals as well as in the chemical one-electron oxidation of iron carbonylate dianions in tetrahydrofuran. Despite considerable effort, we failed to observe the ESR spectrum of the simplest member of this family, the 17-electron $Fe(CO)_4$-.radical anion, although many observations strongly implicated its involvement as a short-lived reaction intermediate. We now find that the closely related (π-olefin)-$Fe(CO)_3$-.radical anions are sufficiently stable, for certain olefins, to be studied by electron spin resonance.

12800 Kintic study of ferrous nitrosyl complexes. Littlejohn, D.; Chang, S.G. (Lawrence Berkeley Lab., CA). *Journal of Physical Chemistry;* **86**: No. 4, 537-540(18 Feb 1982). Contract W-7405-ENG-48.

The formation and dissociation rate constants and equilibrium constants for the reversible binding of NO to Fe/sup II/$(H_2O)_5$, Fe/sup II/(cit), Fe/sup II/$(acac)_2$, and Fe/sup II/(EDTA) in aqueous solution are reported (cit = citrate, acac = acetylacetonate, EDTA = ethylenediaminetetraacetate). The constants were determined (at 25°C) as follows: Fe/sup II/$(H_2O)_5$NO, k_1 = 7.1 x 10^5 M^{-1} s^{-1}, k/sub $^{-1}$/ = 1.5 x 10^3 s^{-1}, K = 470 M^{-1}; Fe/sup II/(cit)NO, k_1 = 4.4 x 10^5 M^{-1} s^{-1}, k/sub $_{-1}$/ = 6.6 x 10^2 s^{-1}, K = 670 M^{-1}; Fe/sup II/$(acac)_2$NO, k_1 = 4.0 x 10^2 M^{-1} s^{-1}, k/$^{-1}$/ = 24 s^{-1}, K = 17 M^{-1}; Fe/sup II/(EDTA)NO, $k_1 \geq 6.0 \times 10^7$ M^{-1} s^{-1}, k/sub $_{-1}$/ $\geq$ 60 s^{-1}. The visible spectra of the complexes are also reported.

12801 Sulfonate precipitation-redissolution-reprecipitation in inorganic electrolytes. Celik, M.S.; Manev, E.D.; Somasundaran, P. (Columbia Univ., New York, NY). *AIChE (American Institute of Chemical Engineers) Symposium Series;* **78**: No. 212, 86-96(1982). (CONF-810417—).

From 90. AICHE national meeting; Houston, TX, USA (5 Apr 1981).

Interacton of inorganics with surfactants can lead to precipitation and consequently to loss of surfactants. Multivalent ions such as Ca^{++} can cause precipitation followed by redissolution at higher surfactant concentration. Redissolution can also be achieved by adding monovalent inorganics such as NaCl. Various possible mechanisms of this phenomenon are discussed on the basis of the data for turbidity, critical micelle concentration, and sulfonate and calcium concentrations. While precipitation is found to be mostly due to the formation of simple calcium sulfonates, redissolution is observed to occur only when micelles are formed. 11 figures, 1 table.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 11598, 11965, 11982, 11991, 12774, 12786, 12788, 12789, 12800, 12801

12802 (DOE/ER/04900—3) Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983. Adams, R.D. (Yale Univ., New Haven, CT (USA)). Dec 1982. Contract AC02-78ER04900. 9p. NTIS, PC A02/MF A01. Order Number DE83004426.

For the past several years we have been investigating the reactivity of hydride containing metal carbonyl cluster compounds with selected heteronuclear unsaturated molecules such as CO, CO_2 and their homologs. In recent months we have discovered a new route for the synthesis of mixed metal carbonyl cluster compounds that involves the reaction of inorganic dinitrogen complexes with unsaturated polynuclear metal carbonyl complexes. In other work we have been investigating the effects of polynuclear coordination on the reactivity of the CO homolog, t-butylisocyanide. These areas of investigation are discussed under the following headings: (1) cluster synthesis via inorganic diazo compounds - synthesis and crystal and molecular structure of H_2IrOs_3 (u-Cl)(u-CO)$(CO)_9PPh_3$; (2) ligand activation - cleavage of an isocyanide triple-bond by a ruthenium cluster. 3 figures.

12803 (DOE/ER/10604—3) Metal-ion complexation by ionic-crown ethers. Progress report. Bartsch, R.A. (Texas Tech Univ., Lubbock (USA). Dept. of Chemistry). 1982. Contract AS05-80ER10604. 21p. NTIS, PC A02/MF A01. Order Number DE83004588.

During the third year of this DOE-funded project, 15 new crown ether compounds with pendant ionizable groups have been synthesized. Although a majority of these compounds are crown ether carboxylic acids, two crown ether sulfonic acids, a crown ether phosphonic acid, and a crown ether phosphonic acid monoalkyl ester have also been prepared. Complexation of alkali metal and alkaline earth cations by these ionizable crown ethers has been assessed by the techniques of solvent extraction, active transport across bulk liquid membranes, and active transport across liquid surfactant membranes. Effects of systematic structural variation within the ionizable crown ether upon the selectivity and efficiency of competitive metal ion complexation have been probed.

12804 (DOE/ER/10624—3) Solid-surface luminescence analysis. Progress report, June 1980-October 1982. Hurtubise, R.J. (Wyoming Univ., Laramie (USA). Dept. of Chemistry). 1982. Contract AC02-80ER10624. 17p. NTIS, PC A02/MF A01. Order Number DE83003048.

Several solid surfaces and experimental conditions were investigated for enhancing the room temperature phosphorescence of hydroxyl aromatics, nitrogen heterocycles, and aromatic amines. Both the inorganic salts absorbed on the solid surfaces and the solvents used to absorb the phosphors on the surfaces were found to be important for maximixing the room-temperature phosphorescence of the phosphors. Reflectance spectroscopy data indicated whether the phosphors were absorbed as neutral molecules, cations, or anions on the surfaces studied. Infrared spectroscopy data revealed the hydrogen bonding interactions between the phosphors and solid surfaces. The results from the salts and solvents experiments, and reflectance and infrared spectroscopy experiments showed some of the important interactions needed for strong room-temperature phosphorescence from phosphors absorbed on solid surfaces. Work was initiated in investigating the fundamental aspects of using both the fluorescence and phosphorescence of compounds adsorbed on solid surfaces in the analysis of mixtures of luminescent compounds.

12805 (INIS-mf—7409, pp 36) Crystal structure of nitromalonamide determined by means of neutron diffraction. Thorup, N. (Danmarks Tekniske Hoejskole, Lyngby:; Simonsen, O. (Odense Univ. (Denmark)); Krebs Larsen, F. (Aarhus Univ. (Denmark)). 1982. (In Danish). NTIS (US Sales Only), PC A03/MF A01.

From 18. Danish crystallographic meeting; Roskilde, Denmark (17 May 1982).

12806 **(INIS-SU—120) Organic chemistry and technology of organic substances. Bioorganic chemistry and biochemistry. Chemistry and technology of high-molecular compounds. Vol. 2.** (AN SSSR, Moscow). 1981. 250p. (In Russian). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83780123.

Selected items in scope for the data base were processed separately. (DLC)

12807 **(IS-T—1032) Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts.** Hauenstein, D.E. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 91p. NTIS, PC A05/MF A01. Order Number DE83004788.

Thesis.

The crystal and molecular structures of two separate isomers for formula $BrCl_2SC_{10}H_7$ from a photochemical cycloaddition reaction of vinyl bromide to 2,3-dichlorobenzo[b]thiophene and a pair of isomers of dichlorocarbonyltris(methyldiphenylphosphine)ruthenium (II), $(MePPh_2)_3Ru(CO)Cl_2$, were determined by the use of three-dimensional, single crystal x-ray analysis and successive structure factor and electron-density map calculations using those independent reflections with $I_o > 3\sigma$/sub I/. Both isomers of $BrCl_2SC_{10}H_7$ (Product 1) crystallize in the monoclinic space group. The molecules are fused benzo[b]thiophenocyclobutane isomers, consisting of a slightly puckered trisubstituted cyclobutane ring. The appropriate name for each isomer is 1-bromo-2,3-(2,3-dichlorobenzo[b]thiopheno)cyclobutane where the bromine atom is either trans (Product 1) or cis (Product 2) with respect to the chlorine positions. Bond angles and bond lengths were calculated for both isomers. Trans-$(MePPH_2)_3Ru(CO)Cl_2$ crystallizes in the monoclinic space group. The spatial arrangement around the ruthenium atom is that of a distorted octahedron with three phosphine moieties, two chlorine atoms and a carbonyl group in the coordination sphere. The three phosphine moieties and the carbonyl group are arranged in a distorted square planar configuration about the ruthenium atom in the trans isomer. For the cis isomer three phosphine moieties and a chlorine atom are arranged in a similar square planar configuration. Bond angles and bond lengths were determined for both isomers. 8 figures, 22 tables.

12808 **Oxidation of hydroxylamine by nitrous and nitric acid.** Bennett, M.R.; Brown, G.M.; Maya, L.; Posey, F.A. (Oak Ridge National Lab., TN). *Inorganic Chemistry;* **21**: No. 6, 2461-2468(Jun 1982). Contract W-7405-ENG-26.

The kinetics of the reaction of hydroxylamine with nitrous acid and with nitric acid were studied in an acidic nitrate medium. The mechanism of the reaction with nitrous acid in an acidic perchlorate medium, proposed by previous workers, is O-nitrosation of the hydroxylammonium ion; our data are consistent with this mechanism at an ionic strength of 2 M. The data at higher ionic strength (3 and 4 M), when compared to an extended treatment of the proposed mechanism, indicate either a deviation from this mechanism at high acid concentration or a change in one of the principal species in solution. Raman and UV spectroscopies were unable to verify a change in the species. In the reaction of hydroxylamine with nitric acid, we identified HNO_2, N_2O, and N_2 as products. This reaction is autocatalytic in HNO_2, and the distribution of products is dependent on the initial concentration of HNO_2, NH_3OH^+, and HNO_2. The product N_2O derives from the nitrosation of NH_3OH^+. HNO_2 with hyponitrous acid, which is an intermediate in the nitrosation of NH_3OH^+. A kinetic model is partially successful in rationalizing the distribution of products.

12809 **Fragmentation mechanism and energetics of some alkyl halide ions.** Rosenstock, H.M.; Buff, R.; Ferreira, M.A.; Lias, S.G.; Parr, A.C.; Stockbauer, R.L.; Holmes, J.L. (National Bureau of Standards, Washington, DC). *Journal of the American Chemical Society;* **104**: No. 9, 2337-2345(5 May 1982). Contract AT01-80EV10373.

Halogen loss from iodoethane, 1-bromopropane, 2-bromopropane, 1-iodopropane, and 2-iodopropane has been studied by means of electron-ion coincidence techniques and by observation of metastable transition. Analysis of the breakdown curves and the study of residence times gave the zero-kelvin thresholds for halogen loss and indicated the size of the kinetic shift. The fragmentation onset for iodoethane was located in a Franck-Condon gap. The zero-kelvin thresholds for the propyl halides were found to lie at or just above the upper spin-orbit level of the parent ion. All of the propyl halides exhibited a unimolecular metastable transition. At fragmentation onset the 2-halopropane ions have negligible fragment kinetic energy while the 1-halopropane produce secondary propyl ions wih 100-200 meV of kinetic energy. It was established that a potential barrier must be surmounted in this fragmentation-isomerization process and analysis suggests a dynamic mechanism other than conventional QET, for example, weak couplings of vibrational modes. Analysis of the 2-halopropane fragmentation thresholds leads to an accurate, absolute value for the proton affinity of propylene, 751.4 +/- 2.9 kJ/mol at room temperature. This value reconciles some differences inherent in the proton affinity scale based on various relative measurements.

12810 **Dehydrogenation processes on nickel and platinum surfaces. Conversion of cyclohexane, cyclohexene, and cyclohexadiene to benzene.** Tsai, M.C.; Friend, C.M.; Muetterties, E.L. (Univ. of California, Berkeley). *Journal of the American Chemical Society;* **104**: No. 9, 2539-2543(5 May 1982).

Described is the surface coordination chemistry of cyclohexane, 1,3- and 1,4-cyclohexadiene, and cyclohexene on the low Miller index planes and a stepped surface of nickel and on the platinum (111) and stepped 6(111)X(111) surfaces as established by thermal desorption spectroscopy, chemical displacement reactions, and isotopic labeling studies. Cyclohexane did not react with Ni(111) at 0 to 70°C, Ni(110) at 20-90°C, Ni(100) at 25-200°C, and Ni[9(111)X(111)] at 20-70°C. A similar behavior was observed for Pt(111) at -35 to +135°C, although a small degree of dehydrogenation was evident on this surface. Definite evidence for cyclohexane conversion to benzene was obtained for the stepped platinum surface; the reactivity of this stepped surface toward cyclohexane was substantially higher than that of the platinum (111) plane. Cyclohexene and 1,3- and 1,4-cyclohexadiene were converted, at least partially, to benzene on all of the nickel and platinum surfaces. Hydrogen-deuterium (C-H) exchange during the conversion of a mixture of chemisorbed C_6H_{10} and C_6D_{10} and of a mixture of chemisorbed cyclochexadiene and deuterium atoms to benzene was evident only for the platinum surfaces. Carbon significantly altered the cyclochexene chemistry on Ni(110);Ni(110)-C was far more effective than the clean surface for dehydrogenation of cyclohexene to benzene. A substantial carbon effect of the chemistry of the other surfaces was not evident.

12811 **Detailed photocurrent spectroscopy of the semiconducting group VI transition metal dichalcogenides.** Kam, K.K.; Parkinson, B.A. (Ames Lab., IA). *Journal of Physical Chemistry;* **86**: No. 4, 463-467(18 Feb 1982). Contract W-7405-ENG-82.

The photocurrent spectra of single crystals of the semiconducting group VI transition metal dichalcogenides (MoS_2, WS_2, WSe_2, and $MoSe_2$) were measured as a function of crystal orientation and surface morphology as well as the polarization and the angle of incidence of the incident radiation. The spectra were analyzed with a band edge analysis revised to include the diffusion of carriers, and estimates of the transition energies were obtained. Structure corresponding to the excitonic transitions was also observed. The results were discussed with respect to the applicability of these materials to solar energy conversion.

12812 **Protein influences on porphyrin structure in cytochrome c: evidence from Raman difference spectroscopy.** Shelnutt, J.A. (Bell Lab., Murray Hill, NJ); Rousseau, D.L.; Dethmers, J.K.; Margoliash, E. *Biochemistry;* **20**: 6485-6497(1981).

To probe the details of protein heme interactions, a Raman difference spectroscopic technique has been developed which allows reliable detection of very small, $\approx$0.01 cm^{-1}, frequency differences. When this technique is applied to heme proteins, structural differences in the protein which perturb the porphyrin macrocy-

cle may be examined by obtaining Raman difference data on the porphyrin vibrational modes which are strongly enhanced in the Raman spectrum produced with visible laser excitation. Reported are Raman difference spectroscopic data on cytochromes c from 24 species. The differences in the Raman spectrum of the porphyrin between the cytochromes c of any two species are small, confirming that all of the cytochromes we have examined have the same "cytochrome fold". However, many small (0.02-2cm^{-1}) but systematic differences were detected which indicate structural differences among these proteins. These differences could be classified into three different groups and interpreted in terms of different types of structural variations resulting from specific differences in the amino acid sequences.(JMT)

4004 Electrochemistry

REFER ALSO TO CITATION(S) 12092, 12097, 12773, 12786

12813 (NDRE/PUBL—81/1003) Behavior of Al electrodes in aqueous solutions. Valand, T. (Forsvarets Forskningsinstitutt, Kjeller (Norway)). Aug 1981. 83p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83900184.

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In this work the behavior of oxide covered Al electrodes in aqueous solutions is treated. Emphasis is laid on the behavior at low electrode potentials, i.e., below approximately -1.0 V(SCE). Based on the general theories of passivation developed by KJ Vetter, a thermodynamic treatment of the electrode is reported. Results obtained from experiments with pure and alloyed Al are given. Usually, the potential step technique was used in these experiments, but other techniques, such as capacity measurements, were also applied. These results are discussed in the light of the thermodynamic treatment, especially when the ion transfer and the oxide formation process is considered. The cathodic hydrogen evolution reaction has been treated by assuming that the step involving electron transfer is rate determining. The effects of oxide thickness and alloying elements on the hydrogen evolution reaction are discussed in accordance with this assumption. In this connection, the effect of separate phases formed on the electrode surface by the alloying elements is also discussed.

4005 Photochemistry

REFER ALSO TO CITATION(S) 12737, 12819, 12820

12814 (DOE/ET/25207—1) Design, evaluation, and application of continuous-flow cells for organic electrochemical synthesis. Final report. Nobe, K. (California Univ., Los Angeles (USA). School of Engineering and Applied Science). 30 Sep 1982. Contract AC02-80ET25207. 96p. NTIS, PC A05/MF A01. Order Number DE83003584.

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Two examples of the oxidation and reduction of aldehydes as a paired synthesis have been studied. These are model systems for potential energy savings in organic electrochemical synthesis. Both are indirect processes; the reduction via alkali metal amalgam and the oxidation via hypobromite. One, using furfural as the substrate, has proved unsuccessful due to the oxidation of its reduction products with the electrogenerated oxidant, bromine. The other paired synthesis, using glucose, has been operated successfully in two types of parallel plate flow cells and two types of porous, packed bed flow cells. To date, the optimum electrode materials and operating conditions for the glucose paired reaction, as determined by product yields and current efficiencies, are an amalgamated zinc cathode, a graphite anode, an initial glucose concentration of 0.8M, a 0.8M NaBr supporting electrolyte and an electrolyte flow rate of 0.8 l/min. Both constant current (10 mA/cm^2) and constant cathode potential (-2.10V vs SCE) electrolyses were performed under the above conditions. Electrolyses carried out in the parallel plate flow cell and the packed bed flow cell in which the current and electrolyte flow are parallel to one another gave comparable results. Lower current efficiencies were obtained in the porous, packed bed flow cell with perpendicular current and flow. The reasons for the poorer results in the perpendicular configuration cell are not known at this time and further experimentation is required with this system. The current efficiencies and yields of both the oxidation reaction (the production of gluconic acid) and the reduction reaction (the formation of sorbitol) in the packed bed cells were found to be dependent on solution pH.

12815 (IS-T—1009) Molecular-beam photoionization studies of molecules and their van der Waals clusters. Ono, Y. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 228p. NTIS, PC A11/MF A01. Order Number DE83004967.

Portions of document are illegible. Thesis.

A new photoionization apparatus incorporating a supersonic molecular beam, a quadrupole mass spectrometer and a 3-meter vacuum ultraviolet monochromator has been used to study the nitric oxide, carbon disulfide, carbonyl sulfide and acetylene molecules along with their van der Waals clusters. Using a wavelength resolution of 0.14 A (FWHM), photoionization efficiency curves were obtained for NO, CS_2, OCS, and C_2H_2 in the respective threshold regions and ionization energy determinations accurate to within 3 MeV were made. The autoionization structures resolved have led to new interpretations and assignments to Rydberg levels. Photoionization efficiency data for the clusters were obtained under lower resolution, typically 1.4 A (FWHM) and led to binding energy determinations of the cluster ions. Other thermochemical values were deduced from fragment appearance energies and sharp rises in ionization efficiencies. From the $(CS_2)_2$ fragment curves, relative reaction probabilities for the formation of the various product channels as a function of the Rydberg level n were determined for $CS_2^*(V,n)$ CS_2 and the branching ratios were measured for the reaction $CS_2^*(V,n) + CS_2$. The shifts observed in the autoionization peaks of the triatomic molecules CS_2 and OCS due to clustering was investigated and a model is proposed which accounts for these characteristics. Ionization of the acetylene dimer and trimer resulted in clusters which could rearrange to form ions of a more stable configuration. Energy dependence measurements of the acetylene dimer fragmentation process yielding $C_4H_3^+$ and $C_4H_5^+$ were found to be consistent with predictions based on the quasi-equilibrium theory.

12816 (SERI-TP—233-1697) Role of porphyrins and chlorophylls in artificial photosynthesis. Connolly, J.S. (Solar Energy Research Inst., Golden, CO (USA)). Jan 1983. Contract AC02-77CH00178. 30p. (CONF-8208106—1). NTIS, PC A03/MF A01. Order Number DE83005105.

From 4. international conference on photochemical conversion and storage of solar energy; Jerusalem, Israel (8 Aug 1982).

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The primary objective for studying artificial photosynthesis is to understand how to induce electron transfer out of an excited singlet state of a donor to a nearby acceptor on a time scale faster than other processes. It is equally important to understand how to stabilize the resulting charge-separated state with respect to the ground state. The model systems use porphyrins and chlorophylls as sensitizers of light-induced electron transfer. Both foward and reverse reactions are being studied systematically with the goal of optimizing the efficiency of charge separation and the kinetics of charge stabilization. Accomplishments in this field are reviewed.

12817 Triplet excitons in 4,4'-dichlorobenzophenone. Singham, S.B.; Pratt, D.W. (Univ. of Pittsburgh, PA). *Journal of Physical Chemistry;* **86**: No. 4, 507-514(18 Feb 1982). Contract AC02-76ER03435.

Low-temperature optical and magnetic resonance experiments, both continuous-wave (CW) and time-resolved, have been performed on photoexcited single crystals of 4,4'-dichlorobenzophenone (DCBP). The CW results show the presence of both triplet excitons and several intrinsic traps in this system. A kinetic model is developed to describe excitation transport between exciton and trap states in the presence of resonant microwaves. By comparing the results of the time-resolved experiments with the predictions of the model, we conclude that the triplet exciton lifetime in DCBP is of the order of microseconds or less. This lifetime, which is much shorter than those in pseudo-one-dimensional sys-

tems, appears to be a consequence of the two-dimensional nature of the exchange interaction in the DCBP crystal.

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 11843, 12471

12818 **(BNL—32211) Characteristics of thermoluminescence glow curves for materials exhibiting more than one glow peak.** Levy, P.W. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 24p. (CONF-820764—2). NTIS, PC A02/MF A01. Order Number DE83004602.

From 3. international seminar on thermoluminescence and ESR dating; Elsinore, Denmark (1 Jul 1982).

The properties of thermoluminescence glow curves, containing one or more glow peaks, have been determined for situations where the assumptions invoked to obtain the usual first and second order kinetics do not apply. First order kinetics occurs only when retrapping is negligible. If more than one glow peak is present and retrapping occurs between different types of traps the glow peaks can be approximated, except in the wings, by the usual first and second order expressions; but often physically unrealistic parameters are obtained. These studies indicate that dating is best accomplished with minerals exhibiting first order kinetics. 6 figures, 1 table.

12819 **(DOE/ER/02001—T1) Radiation-induced effects in organic systems. Final report.** Johnsen, R.H. (Florida State Univ., Tallahassee (USA)). 30 Sep 1982. Contract AS05-76ER02001. 11p. NTIS, PC A02/MF A01. Order Number DE83005056.

This project, which is of twenty-seven years duration, has been devoted to furthering our basic understanding of the processes involved in the absorption and distribution of high-energy radiation in organic molecules. The early phases of the work were concerned with the gross chemical effects of radiation and included studies in a number of important classes of organic compounds including alcohols, aliphatic acids, aliphatic hydrocarbons, and aromatic hydrocarbons. Basic information was acquired through these studies that has led to a better understanding of the effects of high-energy radiation on condensed media. During this period the so-called protective effect of low concentrations of aromatic hydrocarbons was also studied. A contribution of lasting significance at this time was the development of a technique for the post-radiolysis analysis of trapped free radicals by photochemical means. A comprehensive series of papers on the reactions of thermal hydrogen atoms with frozen organic substrates represented the beginning of a new phase in the approach to the problems of radiation chemistry in this laboratory. Since that time the general philosophy guided the research has been to single out events or processes suspected of contributing to the gross-radiation effect and study them in isolation. Thus from 1970 on efforts were devoted to charge-exchange processes, ionization efficiencies (w-values), radical decay process in solids and ion-dissociation reactions. The first by means of a modified time-of-flight mass spectrometer, the second utilizing an ionization chamber constructed in the FSU shops, the third using electron spin resonance detection, and the last involving the use of a dual mass spectrometer, solid target system invented in our laboratory. The most productive of these efforts has been the radical decay work.

12820 **(DOE/EV/03221—75) Nature of oxygen-containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, July 1981-June 1982.** Czapski, G. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1982. Contract AC02-76EV03221. 52p. NTIS, PC A04/MF A01. Order Number DE83004799.

During the past years the main emphasis was given to the properties of HO_2 and O_2^- and OH, mainly in their role in biological systems. We will continue to study and elucidate how O_2^- reacts in biological systems. The toxicity of O_2^- is quite well established but the mechanism is still obscure. One way O_2^- is toxic, was shown by us and others, that OH is formed from O_2^- through reduction of Fe^{3+}, and subsequently the reaction of Fe^{3+} with H_2O_2 (Fenton reaction). This mechanism is sometimes, unjustifiably, called the Haber Weiss Reaction. In this mechanism Cu(II) can often substitute Fe^{3+}. Our recent results proved that in many cases O_2^-, which in its biological activity and toxicity, reduces Cu(II) or Fe(III) can be replaced by other reductants like Vit. C. The role of oxygen, radiosensitizers in radiation damage of bacteriophages and cells will be further studied, as well as on E. coli and enzymes. We will try to elucidate the formation and role of OH, O_2^- and O_2 in these systems as well as the relative contribution of endogenous and exogeneous damage, and the role of direct and indirect radiation damage to cells. Our main emphasis in the near future will concentrate on the effect of copper ions on toxicity of O_2^-. Preliminary results, both with penicillinase as well as with spores and bacteriophages and E. coli, show as if in some of these systems Cu^{2+} sensitizes the damage caused in the absence of copper by up to one hundred fold. This damage is apparently caused by O_2^-. We found that in this sense, O_2^- can be often replaced by Vit. C - both are capable of reducing Cu(II) and both form H_2O_2 (Vit. C only in the presence of oxygen). In the near future we will concentrate on studying the exact mechanism of toxicity of Vit. C and O_2^- in the presence of Cu(II) and will compare the toxicity and its mechanism of Vit. C and O_2^-.

12821 (SAND—82-8882, pp 33-54) **Agglomeration of polyacetylenic particulates and its relation to soot formation.** Schmieder, R.W. (Sandia National Labs., Livermore, CA). Oct 1982. NTIS, PC A08/MF A01.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

The growth of particulates from acetylene gas at ambient temperature has been observed using time-resolved radiolysis. Globular units (termed spherules) with diameters 10 to 30 nm are produced on separate nuclei and agglomerate into quasicrystals agglutinated by liquid polymer. These structures continue to agglomerate and grow by accretion and condensation into nearly perfect spheres with diameters 300 to 500 nm. Finally, the spheres aggregate to form short chains which constitute the yellow-white powder cuprene. Thermal dehydrogenation produces no major changes in the structure of the cuprene. These results suggest that the spherule can be considered to be a common ancestor of both cuprene and hydrocarbon flame soot, i.e., in both cases spherules of acetylenic composition are formed and the growth to large particles is principally by spherule clustering and secondarily by spherule growth. At low temperatures the spherules agglomerate to form cuprene, whereas at high temperature they aggregate and dehydrogenate to form soot. 3 figures.

12822 **ESR study of the attack of photolytically produced hydroxyl radicals on α-methyl-D-glucopyranoside in aqueous solution.** Madden, K.P.; Fessenden, R.W. (University of Notre Dame, IN). *Journal of the American Chemical Society;* **104**: No. 9, 2578-2581(5 May 1982).

Six free radicals were observed when an aqueous solution of H_2O_2 and α-methyl-D-glucopyranoside was photolyzed using the in situ photolysis ESR method: a C6 primary hydroxyalkyl radical, a C2 secondary hydroxyalkyl radical, a C7 primary oxyalkyl radical, a C1 primary oxyalkyl radical, C3 secondary hydroxyalkyl radical, and a C5 secondary oxyalkyl radical. The pH dependence of the concentraion of these species, their reactions, stereochemical factors influencing radical stability, and comparison with product analysis studies are discussed.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 11948, 12718, 12912, 13083, 13145, 13146, 13151

12823 **(IS-T—1004) Partial-equilibrium model based on the kinetics of dissolution and equilibrium in solution of the UO_2-FeS_2-$Fe_2(SO_4)_3$-H_2SO_4 system.** Allen, C.C. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 150p. NTIS, PC A07/MF A01. Order Number DE83004959.

Thesis.

A mathematical model for determining the concentration changes in solution during the dissolution of a uranium dioxide-pyrite mixture has been developed using a $Fe_2(SO_4)_3$-H_2SO_4 lixiviant. When modeling such a leaching process, two different types

of reactions must be considered: heterogeneous dissolution reactions and homogeneous solution reactions. The dissolution reactions occur at kinetically limited reaction rates which are slow enough so that the rapid solution reaction can be assumed to be at continual equilibrium. This situation allows for the partial equilibrium approach to be utilized to model the overall leaching process. In setting up the model, the major solution reactions and aqueous species present during the dissolution process were identified. The initial equilibrium concentration for each of these aqueous species is then determined for a given lixiviant. The modeling process then determines the equilibrium changes for each of these aqueous species for every increment of solid dissolution, with the relative amount of uranium dioxide to pyrite reacting based on the experimentally determined rate expressions. The calculated concentration changes are obtained from simultaneously solving a series of linear equations arising from each equilibrium reaction, a charge balance, and material balances for Fe(III), Fe(II), UO_2^{2+}, and SO_4^{2-}. A computer model was written to perform this iterative process. Results from the model for the dissolution of a uranium dioxide and pyrite mixture were found to agree with the experimental results obtained for similar leach conditions. The $Fe_2(SO_4)_3$-H_2SO_4 solution was found to be an effective lixiviant provided leaching conditions were adjusted for the selective leaching of uranium dioxide.

12824 **(LA-UR—82-3557) Plutonium roundtable discussion.** Penneman, R.A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 7p. (CONF-820909—12). NTIS, PC A02/MF A01. Order Number DE83004733.

From National meeting of the American Chemical Society; Kansas City, MO, USA (1 Sep 1982).

The roundtable discussion began with remarks by the chairman who pointed out the complicated nature of plutonium chemistry. Judging from the papers presented at this symposium, he noticed a pattern which indicated to him the result of diminished funding for investigation of basic plutonium chemistry and funding focused on certain problem areas. Dr. G.L. silver pointed to plutonium chemists' erroneous use of a simplified summary equation involving the disproportionation of Pu(EV) and their each of appreciation of alpha coefficients. To his appreciation of alpha coefficients. To his charges, Dr. J.T. Bell spoke in defense of the chemists. This discussion was followed by W.W. Schulz's comments on the need for experimental work to determine solubility data for plutonium in its various oxidation states under geologic repository conditions. Discussion then turned to plutonium pyrachemical process with Dana C. Christensen as the main speaker. This paper presents edited versions of participants' written version. (ATT)

12825 **(ONWI—399) Thermodynamic properties of chemical species in nuclear waste.** Edelstein, N.; Bucher, J.; Silva, R.; Nitsche, H. (Lawrence Berkeley Lab., CA (USA)). Jan 1983. Contract AC06-76RL01830. 121p. (LBL—14325). NTIS, PC A04/MF A01. Order Number DE83005249.

Thermochemical data on the solubilities of compounds and solution complexes of the waste radionuclides likely to form in the natural systems are required to adequately assess and predict the ability of the storage site to meet established site characteristics and standards for rates of release of radioactive materials set by the US Nuclear Regulatory Commission. Taken as a group, the actinides U, Np, Pu, Am, and Cm represent the largest potential long-term hazard. However, with the exception of U, reliable thermochemical data for even the simple compounds and solution complexes that the important actinides might form with the common ground-water anions is rather incomplete. In particular, very little data exist for the anions, hydroxide, carbonate, and phosphate. Investigations of the hydrolysis of Nd^{3+} (a natural analog for Am and Cm) and Cm^{3+}, the carbonate complexation of NpO_2^+, and the solubilities of Nd^{3+} and Am^{3+} in near neutral pH solutions have been conducted. A value of log K = -7.7 +- 0.3 was obtained for the first hydrolysis constant of both Nd^{3+} and Cm^{3+}. For the carbonate complexes of NpO_2^+, values of 5.9 +- 0.5 for log β_1 and 16.3 +- 0.5 for log β_3 were determined for the formation constants of $NpO_2CO_3^-$ and $NpO_2(CO_3)_3^{5-}$, respectively. From measurements of solution Am concentrations as a function of pH, a value of 17.5 was estimated for the logarithm of the solubility product of amorphous $Am(OH)_3$, i.e., $Am(OH)_3$ (solid) + $3H^+ = Am^{3+} + 3\ H_2O$.

12826 **New method using anhydrous [^{18}F]fluoride to radiolabel 2-[^{18}F]fluoro-2-deoxy-D-glucose.** Levy, S.; Elmaleh, D.R.; Livni, E. (Massachusetts General Hospital, Boston). *Journal of Nuclear Medicine;* 23: No. 10, 918-922(Oct 1982).

A new chemical route for the preparation of 2-[^{18}F]fluoro-2-deoxy-D-glucose (2-^{18}FDG) is discussed using anhydrous [^{18}F]fluoride produced by the $^{20}Ne(d,\alpha)^{18}F$ reaction. The anhydous $^{18}F^-$ is reacted with a previously prepared precursor, methyl 4,6-o-benzylidene-3-o-methyl-2-O-trifluoromethanesulfonyl-β-D-mannopyranoside, in dimethyl formamide or hexamethylophosphoric triamide. The corresponding fluoro-deoxy-glucose derivative, upon treatment with borontribromide or concentrated hydrochloric acid, yields 2-^{18}FDG in 10% (overall) yield. The substrate was characterized by thin-layer chromatography (TLC), and high-performance liquid chromatography (HPLC). Biodistribution studies were performed in mice, and imaging studies in dogs.

12827 **(KFK-tr—673) Design characteristics of a cyclotron for producing radioisotopes.** Akulova, N.V.; Bogdanov, P.V.; Malyshev, I.F.; Moiseev, V.Ya.; Moshkin, V.N.; Myasnikov, Yu.A.; Pyryaev, V.P.; Solames, A.A.; Suvorov, M.M. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). Dec 1981. Translation of NIIEFA P-A-0436, 1979. 24p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900590.

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A description is given of the construction and parts design of a cyclotron for producing radioisotopes in automated target devices and for accelerating protons to an energy of 25 MeV. 8 references, 8 figures, 2 tables.

12828 **US Uranium Registry tissue program.** Moore, R.H.; Breitenstein, B.D. Jr. (Hanford Environmental Health Foundation, Richland, WA). pp 404-406 of Radiation hazards in mining: control, measurement, and medical aspects. Gomez, M. (ed.). New York, NY; American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (1981).

From International conference on radiation hazards in mining: control, measurement, and medical aspects; Golden, CO, USA (4 Oct 1981).

The United States Uranium Registry (USUR) tissue program was funded in 1978 by the United States Department of Energy (DOE) through its Human Health and Assessments Division, and registrant enrollment began in 1980. It is operated by Hanford Environmental Health Foundation (HEHF), Richland, Washington, with support provided by Pacific Northwest Laboratory (PNL). The USUR tissue program is the first systematic effort to contact and gain assistance of workers occupationally exposed to uranium and to seek and study uranium deposition in human tissue. This paper describes the program objectives, populations selected for study, procedures for enrolling workers in the program, types of tissue to be studied, and analytical procedures to be used.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 11766, 12821

12829 **(DOE/ER/10435—2) Laser spectroscopy of combustion intermediates.** Engelking, P.C. (Oregon Univ., Eugene (USA)). 1982. Contract AT06-79ER10435. 6p. NTIS, PC A02/MF A01. Order Number DE83004869.

The use of laser techniques to probe reaction systems, including combustion, requires knowledge of the spectra of the reacting species. Our current research goal is to provide spectroscopic information on molecular radicals important to combustion. Our group has extended the capabilities of our laser induced fluorescence apparatus by placing laser, monochromator, and detection electronics under computer control. This greatly increases the rate at which data may be collected. We have used this apparatus to generate spectra of a $^4\Sigma^-$ - $X^3\pi$ of CF, and the A - X and B - X

transitions in several cyano radical cations of the structure XCN^+. We have observed an unidentified transition that we tentatively identify with HCN^+. Laser induced fluorescence spectra of methoxyl radicals have been observed at vibrational resolution. Our analysis of the fluoromethylidyne intersystem transition a $^4\Sigma^- - X^2\pi$ is complete. We have established the intersystem energy difference through our value of T_0, and have measured the bond length increase in the a $^4\Sigma^-$ state through b_0.

12830 (DOE/PC/30300—T6) **Particulate processes in pulverized-coal flames. Quarterly technical progress report, July-September 1982.** (Spectron Development Labs., Inc., Costa Mesa, CA (USA)). Dec 1982. Contract AC22-80PC30300. 23p. NTIS (US Sales Only). Order Number DE83004685.

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The primary objective of the present investigation is to obtain fundamental physical data on particulate reaction processes in pulverized-coal flames. Specific particulate processes to be considered are: feed coal devolatilization and ignition, soot formation and burnout, char burnout, large flyash melt and agglomeration, and fine flyash vaporization and condensation. Significant progress has been made in the application of nonintrusive optical diagnostic methods to paticulate processes in combustion. Perhaps the most dramatic application to date is the capture of devolatilization and ignition events of feed coal particles using nano-second pulsed laser holography and shadowgraphy. Equally important are the capabilities to: (1) measure simultaneously the size and velocity of individual particles in the range of 3 to 300 μm, and (2) to measure the size of individual submicron particles. The latter techniques have been demonstrated in combustion flowfields and offer the opportunity to obtain particle size statistics, an important missing link in the existing mostly qualitative data base for particulate processes in coal flames. A key consideration of the present program will be the development of laboratory combustor capable of conducting a comprehensive experiment. This implies that temperatures and residence times will be adequate to achieve char and soot burnout and ash vaporization. It is also important that temperatures are not so high as to produce nonrealistic reaction rates. The need exists to develop information relevant to both dilute and dense particulate-laden reacting flows.

12831 (EPRI-NP—2637) **Effect of water fogs on the deliberate ignition of hydrogen. Final report.** Zalosh, R.G.; Bajpai, S.N. (Factory Mutual Research Corp., Norwood, MA (USA)). Nov 1982. 81p. NTIS, PC A05/MF A01. Order Number DE83900639.

This report presents an experimental evaluation of the effects of water fog density, droplet diameter, and temperature on the lower flammable limit (LFL) of hydrogen-air-steam mixtures. The results show that the LFL for hydrogen in air at 20°C is only marginally higher with fog than without. Most of the nozzles tested at 20°C raised the hydrogen LFL from 4.0 vol % to about 4.8%, for the case of dense fogs with volume-average drop size in the range 45 to 90 microns. The lower flammable limit at 50°C was typically 7.2% for dense fogs with drop size in the range 25 to 50 microns. The lower flammable limit at 70°C was typically 7.6%. Typical fog concentrations ranged from 0.03 to 0.09 vol % at 20°C and decreased with increasing fog temperature. 7 figures, 4 tables.

12832 (SAND—82-8882) **Combustion research presented at the 19th international symposium on combustion, Haifa, Israel, August 8-13, 1982.** (Sandia National Labs., Livermore, CA (USA)). Oct 1982. Contract AC04-76DP00789. 171p. (CONF-820801—Exc.). NTIS, PC A08/MF A01. Order Number DE83003149.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

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The 19th international symposium on combustion was held in Haifa, Israel during August 8 to 13, 1982. Sandia National laboratories presented seven papers at that conference, and those contributions are collected in this volume. All papers have been abstracted and indexed for inclusion in the Energy Data Base.

12833 (SAND—82-8882, pp 77-100) **Mass fluxes anti rho' anti u' and anti rho' anti nu' measured in a turbulent nonpremixed flame.** Driscoll, J.F. (Univ. of Michigan, Ann Arbor); Schefer, R.W.; Dibble, R.W. Oct 1982. NTIS, PC A08/MF A01.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

Turbulent axial and radial mass fluxes rho'u' and rho'nu' have been measured throughout a high Reynolds number (Re/sub d/ == 24,000) turbulent nonpremixed flame. In addition, the probability distributions of density and velocity have been measured, from which the means, higher moments and spatial gradients are generated. These measurements were made with a novel apparatus which combines laser velocimetry with laser Rayleigh scattering. Results indicate that the gradient diffusion assumption that is commonly made to model rho'u' in first order closure theories is seldom obeyed throughout the flow. This is direct evidence of countergradient diffusion of density in a nonpremixed flame. The radial fluxes rho'nu' are found to follow a gradient diffusion relation throughout the flow. 12 figures.

12834 (SAND—82-8882, pp 131-150) **Percolation in combusting sprays I: transition from cluster combustion to percolate combustion in non-premixed sprays.** Kerstein, A.R. (Sandia National Labs., Livermore, CA); Law, C.K. Oct 1982. NTIS, PC A08/MF A01.

From 19. international symposium on combustion; Haifa, Israel (8 Aug 1982).

Percolation theory, which addresses the connectedness of randomly-defined regions of space, is used to investigate the geometry of the flame surface of a combusting spray in the fast-chemistry, clame-sheet limit. In particular, percolation theory predicts the existence of two distinct combustion regimes in non-premixed sprays, regimes defined herein as cluster combustion and percolate combustion. These regimes are natural generalizations of isolated droplet combustion and external group combustion respectively. The time evolution of the boundary between the two regimes is analyzed for a simple model problem, leading to predictions of the novel phenomena of flame expulsion and flame exclusion due to geometrical effects. 1 figure.

42 ENGINEERING

4201 General Engineering

12835 **Fundamentals of tribology.** Suh, N.P.; Saka, N. (eds.). Cambridge, Massachusetts; The MIT Press (1980). 1224p. (CONF-780666—). Contract AP02-78ER05011.

From Conference on fundamentals of tribology; Cambridge, MA, USA (19 Jun 1978).

This book presents the proceedings of the June 1978 International Conference on the Fundamentals of Tribology. The papers discuss the effects of surface topography and of the properties of materials on wear; friction, wear, and thermomechanical effects; wear mechanisms in metal processing; polymer wear; wear monitoring and prevention; and lubrication. (LCL)

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 11737, 11821, 11860, 11861, 11896, 11975, 11977, 12445, 12793, 12866, 12895, 13005, 13491, 13493

12836 (AD-A—118439/9) **Discrete frequency noise and its reduction in small axial-flow fans. Technical memo.** Fitzgerald, J.M. (Pennsylvania State Univ., University Park (USA). Applied Research Lab.). 2 Mar 1982. 147p. (ARL/PSU/TM—82-76). NTIS, PC A07/MF A01.

The discrete frequency noise radiated from representative types of axial-flow fans used in electronic equipment is studied in detail. Narrowband analysis of the discrete frequency noise radiated by these types of fans has been conducted in a free-field environment. The far-field sound pressure level, radiated directivity, and total radiated power of the discrete frequency noise is presented. The influence of operating point on the sound radiated from the

fans is determined. The discrete frequency noise dominates the characteristic acoustic spectra at high flow coefficients.

12837 **(AD-A—119356/4) Closed cycle cryocooler for low temperature electronic circuits. Phase II. Preliminary design. Final report 15 May-30 Sep 81.** Pirtle, F.W. (CTI-Cryogenics, Inc., Waltham, MA (USA)). Aug 1982. 80p. NTIS, PC A05/MF A01.

This study program was conducted under Office of Naval research contract N00014-81-C-0525 to develop a preliminary design of a small, low power, very low magnetic signature, lightweight, efficient closed cycle cryocooler suitable for use with superconductive and other low temperature electronics circuits. The preliminary design is directly based on the results of the Phase I concept study (contract N00014-80-C-0465).

12838 **(CEA-N—2254) Study and organization of the maintenance of electronic equipment.** Helenon, Charles. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1982. 262p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE82703375.

Thesis.

This work has consisted in the observation of maintenance actions analysing not only the times but also the cost to repair. The good use of multidimensionnal analysis brought a photograph of the maintenance section of the Nuclear Instrumentation Department of Saclay's Research center. This image resulted in different parameters all external (cost, number of repair,...) leading to the efficiency of the action, to the technological complexity of the item, or the ability to find faults, Beyond these verifications one can dispose of means to evaluate maintenance. In order to group, to sort or to sample data it was necessary to dispose of the computer support necessary for calculations and handling the maintenance data. This tool and the necessary sofware were developed on this occasion. The APL sofware rest on a common structure basis conceived for simplicity and the ease of the user.

12839 **(CONF-821216—1) Remote-Systems Demonstration Facility. Consolidated Fuel-Reprocessing Program.** Hamel, W.R. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 27p. NTIS (US Sales Only). Order Number DE83004607.

From Joint US/Japan Power Reactor and Nuclear Fuel Development Corporation conference; Tokyo, Japan (6 Dec 1982).

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The Remote Systems Demonstration Facility (RSDF) is a facility used for the evaluation of remote techniques and procedures being developed in the Remote Control Engineering task. The RSDF is presently comprised of three parts: (1) in-cell handling, TV viewing, power and signal transmission equipment; (2) a remotely located control room with servomanipulator master controllers and a full complement of development displays and controls, and (3) various tooling and work task mockup equipment. Future activities in the RSDF will include: (1) experimental evaluation of large-volume TV viewing parameters; (2) acquisition and analysis of servomanipulator joint drive duty cycles; (3) voice input and output control; and (4) robotic operation of the TOS slaves for automatic tool changing.

12840 **(CONF-821216—3) Consolidated Fuel-Reprocessing Program. Servomanipulator control systems.** Martin, H.L.; Babcock, S.M. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE83004510.

From Joint US/Japan Power Reactor and Nuclear Fuel Development Corporation conference; Tokyo, Japan (6 Dec 1982).

Servomanipulators have been used for remote work activities for several decades. During this time many control philosophies have been applied to the problem with one objective in mind - develop a servomanipulator system which is as sensitive as direct mechanical master/slave manipulators while offering unlimited work space coverage. This paper traces the development of the servo control loops which have been used, discusses the design considerations involved in applying digital techniques to the servo-loop control, and reviews the analysis and simulation of the servo control technique used for the Industry Standard Manipulator (ISM).

12841 **(CONF-821216—4) Consolidated Fuel-Reprocessing Program. ASM mechanical system.** Kuban, D.P. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE83004609.

From Joint US/Japan Power Reactor and Nuclear Fuel Development Corporation conference; Tokyo, Japan (6 Dec 1982).

The mechanical system of the Advanced Servo Manipulator (ASM) has evolved from reprocessing facility goals. These goals of increased availability, and decreased mean time to repair, lead to a new generation manipulator that will be highly reliable and easy to repair. The specific requirements arrived at after a year or more of study and evaluation are: operate in reprocessing cell environment; interchange with all handling systems; operate within 48-in. module construction for remote repair; decontaminable; and high reliability and low repair time. The cell environment is particularly hostile, but typical for reprocessing facilities: high radiation, nitric acid, and airborne particulate are the primary degrading factors that the ASM must endure. It must also be interchangeable with the overhead telescoping tube system, the floor transporter, the rescue vehicle, and the wall-mounted handling systems. It is designed to operate within the present 48-in. module spacing, and be decontaminable for module repair.

12842 **(CONF-821216—6) Industry-standard manipulator integrated maintenance system. Consolidated Fuel-Reprocessing Program.** Herndon, J.N. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 28p. NTIS, PC A03/MF A01. Order Number DE83004608.

From Joint US/Japan Power Reactor and Nuclear Fuel Development Corporation conference; Tokyo, Japan (6 Dec 1982).

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The industry-standard manipulator (ISM) system is being developed as part of the on-going program to develop the remote maintenance technology which will be required in future nuclear-facility applications, particularly breeder reprocessing plants. The objectives are to provide man-equivalent maintenance capabilities in hazardous environments through the utilization of force-reflecting, teleoperated manipulators and television viewing and to demonstrate and evaluate servomanipulator-based remote maintenance on prototypic reprocessing equipment in the Remote Operation and Maintenance Demonstration Facility (ROMD) at ORNL. These demonstration tasks will include maintenance operations on prototype fuel disassembly and shearing equipment, a prototype rotary fuel dissolver, and a simulated reprocessing equipment rack module. The ISM slave package will be installed on one of the two ROMD overhead telescoping tube trolleys presently equipped with power-type manipulators. During these maintenance task demonstrations, mean-time-to-repair related equipment maintenance data will be recorded for potential plant design application. The ISM system features the use of brushless dc servomotors to replace the previously used two-phase ac servomotors for manipulator drives, and will utilize modern digital microprocessor-based control hardware to replace the previously used analog control system. This reduces the control conductor count from ~ 30 conductors to four coax cables for manipulator control and provides a fully integrated slave package with viewing, lighting, hoisting capabilities provided with the slave package, and an integrated master operator interface system.

12843 **(CONF-821216—8) Advanced servomanipulator performance summary. Consolidated Fuel-Reprocessing Program.** Martin, H.L. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 8p. NTIS, PC A02/MF A01. Order Number DE83004507.

From Joint US/Japan Power Reactor and Nuclear Fuel Development Corporation conference; Tokyo, Japan (6 Dec 1982).

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The general requirements for evaluating the performance of the Advanced Servomanipulator (ASM) are discussed. The requirements relate to range of motion, maximum and minimum torque, position error, and manipulator availability, including ease of repair or replacement following failure. (LCL)

12844 **(CONF-821216—9) Servomotor test stand. Consolidated Fuel-Reprocessing Program.** Martin, H.L.; Kuban, D.P. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01. Order Number DE83004508.

From Joint US/Japan Power Reactor and Nuclear Fuel Development Corporation conference; Tokyo, Japan (6 Dec 1982).

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The performance of any force-reflecting servomanipulator is dependent on the servo-loop control quality. A test stand has been developed to study parameters important in servo-loop design and operation. Among the topics of interest are effects of torque tube force transmission on response (backlash, inertia, and friction), selection of subsystem components which perform best in this application (motors, sensors, and electrical connectors), and mechanical integrity (lubrication, materials, and reliability). Plans for designing a Servo-Motor Test Stand (SMTS) with the flexibility to meet these varied experimental purposes are discussed.

12845 **(DOE/ET/12457—T10) One-inch flexible drill for resin bolter module. Final technical report, Phases I and II, September 30, 1977-April 30, 1981.** Brummert, L.; Krois, P. (Bendix Corp., Englewood, CO (USA). Energy and Environmental Technology Dept.). Nov 1982. Contract AC22-77ET12457. 41p. NTIS, PC A03/MF A01. Order Number DE83005277.

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A longer-than-seam height flexible-steel roof drill for one-inch diameter holes was designed, fabricated and laboratory tested. A microprocessor control system and roof drill adaptive hardware for a government-supplied automated resin bolter module were designed, fabricated, installed and tested. The roof drill, under separate test, met the reliability goal of 935 Mean-Holes-Between-Failures. The drill design goals were in general met or exceeded.

12846 **(EGG—1183-5101) Operations manual: fiber-optics welder.** Higgins, R.W. (EG and G, Inc., Los Alamos, NM (USA)). Mar 1978. Contract AC08-76NV01183. 21p. NTIS, PC A02/MF A01. Order Number DE83005875.

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The design and electrical and mechanical characteristics of an ac-powered diffuse arc fusing device for the butt-welding of glass fibers are described, and instructions are given for the assembly, dismantling, maintenance, repair and storage of the fiber optics welder. (LCL)

12847 **(IFVE-OMVT/OUNK—81-121) MULTIC program for computing three-dimensional magnetic fields of superconducting magnets.** Balbekov, V.I.; Tkachenko, L.M.; Fedoseev, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703396.

The MULTIC computer code intended for computing the three-dimensional magnetic fields of superconducting magnets is described. For numerical calculation of magnetic fields the method of integral equations is used. The MULTIC computer code is written in the FORTRAN for the ICL-1906 A computer. The computer code volume is 60 K 24-digit words of the ICL-1906 A computer. An example of computer code operation at the calculation of a single-layer dipole is given. Calculation of the dipole three-dimensional magnetic field using the MULTIC computer code takes about 4 min. It is pointed out that the field calculation accuracy depends on the number of iron partition elements as well as on the quality of partition. It is sufficient to partition superconducting dipole iron into 24 elements to obtain the accuracy of calculation of the order of 10^{-4}.

12848 **(KFK—3240) Stability of NbTi composite superconductors of high CU/SC-ratio.** Turowski, P.; Lin, L.Z. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Apr 1982. 11p. (In English). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750936.

Investigations with respect to stability behaviour were made on NbTi composite multifilamentary conductors of a Cu/SC ratio of 10 in magnetic field from 7 T up to 10 T. The recovery currents in dependence on the magnetic field were determined under bath cooling conditions at 4.2 K for a heat disturbance of 0.6 Joule. The current sharing regime turned out to be very extended due to the high copper content and consequently offered a safety margin in magnets in case of transient overcurrents. The copper stabilizer was attached to the superconductor in different ways but the stability behaviour was not changed.

12849 **(KFK—3287) Transport in rotary drums and ball mills.** Roth, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Isotopentechnik). Mar 1982. 199p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE82750920.

This report contains investigations into the influence exerted by operating conditions, material properties and geometry of the apparatus and of the discharge plate on the transport behaviour of narrow quartz sand fractions in a model apparatus. The transport coefficients are determined in residence time experiments with Na-24-labelling. The dependence obtained between the transport coefficients and the experimental parameters permits a coherent interpretation if the assumption is made that the two types of transport occur in different phases of radial motion: Convection takes place during ascend while axial dispersion is generated in the falling and ranging process. Furthermore, a model has been developed for evaluating the throughput of rotary drums and ball mills, respectively; it is based on the assumption that the throughput is governed by the material flux through the discharge plate. The efflux takes place only in the ascending zone as a result of gravity and centrifugal forces acting parallel to the discharge plate. A deduced relationship describing the material flow through the discharge apertures in connection with the calculable zone of ascend leads to an expression allowing to determine the mass flow rate as a function of material properties, operating conditions and geometry of the discharge plate. A comparison between experimental and calculated data shows good agreement.

12850 **(LA—9466-MS) Los Alamos National Laboratory building cost index.** Orr, H.D.; Lemon, G.D. (Los Alamos National Lab., NM (USA)). Oct 1982. Contract W-7405-ENG-36. 6p. NTIS, PC A02/MF A01. Order Number DE83003996.

The Los Alamos National Laboratory Building Cost Index indicates that actual escalation since 1970 is near 10% per year. Therefore, the Laboratory will continue using a 10% per year escalation rate for construction estimates through 1985 and a slightly lower rate of 8% per year from 1986 through 1990. The computerized program compares the different elements involved in the cost of a typical construction project, which for our purposes, is a complex of office buildings and experimental laboratories. The input data used in the program consist primarily of labor costs and material and equipment costs. The labor costs are the contractual rates of the crafts workers in the Los Alamos area. For the analysis, 12 field-labor craft categories are used; each is weighted corresponding to the labor craft distribution associated with the typical construction project. The materials costs are current Los Alamos prices. Additional information sources include material and equipment quotes obtained through conversations with vendors and from trade publications. The material and equipment items separate into 17 categories for the analysis and are weighted corresponding to the material and equipment distribution associated with the typical construction project. The building cost index is compared to other national building cost indexes.

12851 **(LALP—82-34) Magnetic refrigeration: the basis for a new refrigeration technology. Los Alamos Mini-Review.** Keller, W.E. (Los Alamos National Lab., NM (USA)). Nov 1982. Contract W-7405-ENG-36. 4p. NTIS, PC A02/MF A01. Order Number DE83004319.

The history of and operating principle for magnetic refrigeration, the selection of magnetic refrigeration materials with favorable thermomagnetic properties, e.g., gadolinium alloys and compounds, the advantages of greater compactness, efficiency and reliability for magnetic refrigeration as compared with conventional

gas systems, and research in this field at Los Alamos are described. (LCL)

12852 (LBL—14859) Design conditions for fail-safe quenching of a high-current-density superconducting solenoid with a shorted secondary circuit. Green, M.A. (Lawrence Berkeley Lab., CA (USA)). Sep 1982. Contract AC03-76SF00098. 108p. NTIS, PC A06/MF A01. Order Number DE83005122.

The key to fail safe quenching of large high current density superconducting magnets without external quench protection is to make the whole magnet become normal quickly. In large high current density superconducting magnets, quench propagation in the coil often does not cause the coil to become normal fast enough to insure quenching without burnout. If a shorted secondary circuit is added, the process of the magnet turning normal is speeded up through the process we call quench back. This report deals with the quench back process. The parameters which affect thermal quench back are examined. The report presents ways of speeding up the quench back process so that fail safe quenching can be achieved even in very large high current density magnets. Theoretical calculations are made to illustrate the effect of various parameters on quench back time and the ability for the coil to quench safely.

12853 (LCC—017/81) Finite element for plates and shells. Muller, A.; Feijoo, R.A.; Bevilacqua, L. (Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil)). Aug 1981. 11p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703339.

A simple triangular finite element for plates and shells, is presented. Since the rotation fields are assumed independent of the displacement fields, the element allows one to solve thick shells problems. In the limit for thin shell, the Kirchoff-Love hypothesis is automatically satisfied, thus enlarging its range of application.

12854 (NUREG/CR—3006) Damping in building structured during earthquakes: test data and modeling. Coats, D.W. Jr. (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 208p. (UCRL—53043). NTIS, PC A12/MF A01 - GPO. Order Number DE83004284.

Portions of document are illegible. Thesis.

A review and evaluation of the state-of-the art of damping in building structures during earthquakes are presented. The primary emphasis is in the following areas: the evaluation of commonly used mathematical techniques for incorporating damping effects in both simple and complex systems; an evaluation of structure testing methods and building instrumentation practices, and an investigation of rigid-body rotation effects on damping values from test data.

12855 (ORNL/CSD/TM—149) Scoping design analyses for optimized shipping casks containing 1-, 2-, 3-, 5-, 7-, or 10-year-old PWR spent fuel. Bucholz, J.A. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 320p. (TTC—0316). NTIS, PC A14/MF A01. Order Number DE83005179.

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This report details many of the interrelated considerations involved in optimizing large Pb, Fe, or U-metal spent fuel shipping casks containing 1, 2, 3, 5, 7, or 10-year-old PWR fuel assemblies. Scoping analyses based on criticality, shielding, and heat transfer considerations indicate that some casks may be able to hold as many as 18 to 21 ten-year-old PWR fuel assemblies. In the criticality section, a new type of inherently subcritical fuel assembly separator is described which uses hollow, borated stainless-steel tubes in the wall-forming structure between the assemblies. In another section, details of many n/γ shielding optimization studies are presented, including the optimal n/γ design points and the actual shielding requirements for each type of cask as a function of the age of the spent fuel and the number of assemblies in the cask. Multigroup source terms based on ORIGEN2 calculations at these and other decay times are also included. Lastly, the numerical methods and experimental correlations used in the steady-state and transient heat transfer analyses are fully documented, as are pertinent aspects of the SCOPE code for Shipping Cask Optimization and Parametric Evaluation. [While only casks for square, intact PWR fuel assemblies were considered in this study, the SCOPE code may also be used to design and analyze casks containing canistered spent fuel or other waste material. An abbreviated input data guide is included as an appendix].

12856 (Y—2277) Regrinding and relapping of single-point, single-crystal diamond turning and boring tools. Duke, W.L.; Lovell, R.T. (Oak Ridge Y-12 Plant, TN (USA)). Dec 1982. Contract W-7405-ENG-26. 26p. NTIS, PC A03/MF A01. Order Number DE83005176.

Single-crystal, single-point diamond tools have been successfully ground and lapped to specific geometries with chip-free cutting edges for producing mirror-like surfaces on nonferrous materials. It was found that the grinding and lapping facility required a special controlled environment and specially constructed grinding and lapping machines. Cleanliness was found to be of utmost importance. Special inspection techniques were used to ensure very accurate and repeatable measurements. Exceptional care is required in handling, grinding, lapping, inspecting, and packaging to prevent cutting edge chippage on the diamond.

12857 (Y/DX—111) Control-systems improvements in a precision coordinate measuring machine. Douglass, S.S.; Babelay, E.F. Jr.; Green, W.L.; Igou, R.E.; Woodard, L.M. (Oak Ridge Y-12 Plant, TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Electrical Engineering). 8 May 1980. Contract W-7405-ENG-26. 6p. (CONF-800805—5). NTIS, PC A02/MF A01. Order Number DE83005511.

From Joint automatic control conference; San Francisco, CA, USA (13 Aug 1980).

A conventional, manually driven Moore No. 3 coordinate measuring machine at the Oak Ridge Y-12 Plant is being upgraded to provide a continuous-path numerical control capability and simultaneously to serve as a vehicle for testing new machine slide control concepts. Besides new lead screw drive motors, an NC machine control unit and closed-loop servo system, the machine has also been equipped with vibration isolation, air-bearing slideways, and laser interferometric position feedback. The present conventional slide servo system will be replaced with a digital servo system wherein various feed back and compensation techniques can be realized through the use of a high-speed dedicated digital processor. This paper describes the improvements to date with emphasis on identification and compensation of the slide control systems.

12858 DOT's proposed routing for radioactive material shipments. Mahathy, J.M.; Jacobs, D.G. (Evaluation Research Corp., Oak Ridge, TN). *Nuclear Safety;* **23**: No. 5, 509-514(Sep-Oct 1982).

This article reviews proposed amendments to the Code of Federal Regulations, Title 49, which would give the Department of Transportation (DOT) the authority to establish a system of highway routes for vehicular shipments of large-quantity radioactive materials. These amendments would modify existing regulations pertaining to route plans, driver training, and special vehicle placards. The need for a federal routing authority stems from the establishment by state and local governments of regulations that prohibit or severely hamper shipments of radioactive materials within their jurisdictional boundaries. DOT felt that the transportation risks were sufficiently low that these restrictions were unjustified, so they proposed the amendments to establish nationwide uniformity with regard to the transportation of radioactive materials. The interstate highways were chosen as the main route system for large-quantity shipments. A specific route system for low-level shipments was not mandated because these materials do not present significant hazards. This should result in less regulation of low-level shipments. However, a federal court injunction has temporarily set aside the implementation of the law.

12859 Full-scale impact tests of simulated high-level waste canisters. Slate, S.C. (Battelle-Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352). *Transactions of the American Nuclear Society;* **41**: 160(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12860 **The physiological limitation of working in a radiation containment suit.** Hatcher, J.J.; Brown, K.A. (Atlantic Nuclear Services, Inc., P.O. Box 12716, Norfolk, VA 23502). *Transactions of the American Nuclear Society;* **41**: 180-181(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

12861 **Bag-out material-handling system.** Brak, S.B.; Milek, H.F. (to Dept. of Energy). US Patent Application 6-352,743. 26 Feb 1982. 26p. Contract W-31-109-ENG-38.

A bagging device for transferring material from a first chamber through an opening in a wall to a second chamber includes an outer housing communicating with the opening and having proximal and distal ends relative to the wall. An inner housing having proximal and distal ends corresponding to those of the outer housing is mounted in a concentrically spaced, sealed manner with respect to the distal end of the outer housing. The inner and outer housings and mounting means therebetween define an annular chamber, closed at its distal end and open at its proximal end, in which a pliable tube is slidably positioned in sealed engagement with the housings. The pliable tube includes a sealed end positioned adjacent the proximal end of the inner housing so as to maintain isolation between the first and second chambers. Displacement of the material to be bagged from the first chamber along the inner housing so as to contact the sealed portion of the pliable bag allows the material to be positioned within the pliable bag in the second chamber. The bag is then sealed and severed between where the material is positioned therein and the wall in providing a sealed container for handling the material. The pliable tube when substantially depleted slides onto a narrow portion of the inner housing to allow a new pliable tube to be positioned over the old pliable tube. Remnants of the old pliable tube are then discharged into the new pliable tube with the bagging and removal of additional material.

12862 **Design guides for radioactive material handling facilities and equipment.** Doman, D.R.; Barker, R.E.; Burton, J.H. (Westinghouse Hanford, Richland, WA 99352). *Transactions of the American Nuclear Society;* **35**: 607(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

12863 **Analysis and model testing of a Super Tiger Type B Waste transport system in accident environments.** May, R.A.; Joseph, B.J.; Romesberg, L.E.; Yoshimura, H.R. (Sandia Natl Labs, Albuquerque, NM 87115). *Transactions of the American Nuclear Society;* **35**: 110-111(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

4203 Lasers

REFER ALSO TO CITATION(S) 12937, 12992, 13497

12864 **(BNL—32086) One-dimensional numerical simulation of a free-electron laser - storage-ring system.** Luccio, A.; Pellegrini, C. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 3p. (CONF-820988—2). NTIS, PC A02/MF A01. Order Number DE83002818.

From Free electron laser conference; Bendor, France (26 Sep 1982).

We describe the results obtained by a one-dimensional numerical simulation of a free-electron laser-storage-ring system. The laser power build-up in the optical cavity, the dependence of the saturated power from the gain-to-losses ratio and the electron and photon pulse shapes are calculated.

12865 **(LA-UR—82-3621) Linac technology for free-electron lasers.** Cooper, R.K.; Morton, P.L.; Wilson, P.B.; Keefe, D.; Faltens, A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 19p. (CONF-820988—4). NTIS, PC A02/MF A01. Order Number DE83004740.

From Free electron laser conference; Bendor, France (26 Sep 1982).

Electron linear accelerator technology for high-power, short-wavelength free-electron lasers is reviewed.

12866 **Laser-beam-alignment system.** Kasner, W.H.; Racki, D.J.; Swenson, C.E. (to Dept. of Energy). US Patent Application 6-352,744. 26 Feb 1982. 12p. Contract W-7405-ENG-26.

A plurality of pivotal reflectors direct a high-power laser beam onto a workpiece, and a rotatable reflector is movable to a position wherein it intercepts the beam and deflects a major portion thereof away from its normal path, the remainder of the beam passing to the pivotal reflectors through an aperture in the rotating reflector. A plurality of targets are movable to positions intercepting the path of light traveling to the pivotal reflectors, and a preliminary adjustment of the latter is made by use of a low-power laser beam reflected from the rotating reflector, after which the same targets are used to make a final adjustment of the pivotal reflectors with the portion of the high-power laser beam passed through the rotating reflector. The system was developed to cut the casings of spent nuclear fuel elements into segments as the initial step in recovering usable fuel. (WHK)

12867 **Can optical phase conjugators produce a very short conjugate pulse.** Suydam, B.R. (Los Alamos National Laboratory, Los Alamos, NM). pp 319-322 of Lasers '80. Collins, C.B. McLean, VA; STS Press (1981).

From 3. international conference on lasers and applications; New Orleans, LA, USA (15 Dec 1980).

In studying the transient behavior of phase conjugation via four-wave mixing, it has been found that very short probe pulses invariably produce considerably broadened conjugate pulses unless the conjugator is inordinately short. It is sought here to determine whether a short conjugate pulse might be produced by judicious programming of the probe. It is found that the probe can indeed be tailored to produce an arbitrarily short conjugate signal and that, if the conjugating medium exhibits linear absorption, then the total energy in the probe signal is finite. The probe programming required can be determined by numerical evaluation of a Fourier transform.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 11638, 11655, 11656, 12314, 12315, 12345, 12452, 13418

12868 **(EUR—7427/1-EN) CONVEC: a computer program for transient incompressible fluid flow based on quadratic finite elements. Part I. Theoretical aspects.** Laval, H. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 55p. European Community Information Service, 2100 M Street, NW, Suite 707, Washington, DC.

The theoretical and numerical aspects of the finite element computer code CONVEC are described. The code was designed for the transient analysis of two-dimensional plane or three-dimensional axisymmetric incompressible flows including the effects of heat transfer. The governing equations for the above class of problems are the time-dependent incompressible Navier-Stokes equations and the thermal energy equation. The general class of flow problems analyzed by CONVEC is discussed and the equations for the initial-boundary value problem are presented. The finite element method and the weighted residual formulation are presented. The numerical solution of the incompressible equations using a fractional step method is discussed. The mass lumping process associated with an explicit time integration scheme is described. The time integration is analyzed and the stability conditions are derived. Finally, numerical applications are presented. Standard problems of natural

and forced convection are solved and the solutions obtained are compared with other numerical solutions published.

12869 **(KFK—3318) Experimental investigations on the fluid flow through an asymmetric rod bundle (W/D = 1.118).** Rehme, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Apr 1982. 63p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82750935.

Measurements of the distributions of the mean velocity, the wall shear stresses and the turbulence were performed in a wall subchannel of a rod bundle of four parallel rods arranged asymmetrically in a rectangular channel (P/D = 1.07, W/D = 1.118). The Reynolds number of this investigation was Re = 1.05×10^5. The experimental results show that the momentum transport is highly anisotropic especially in the gaps of the rod bundle. Influences of secondary flow cannot be detected in the distribution of the time-mean velocity, however, such influences are found in the distributions of the turbulence intensities and the kinetic energy of turbulence. The comparison between experimental wall shear stress distributions and those calculated with the VELASCO-code shows discrepancies especially in the gap between the rod and channel walls.

12870 **(SAND—77-1332-Rev.) COYOTE: a finite-element computer program for nonlinear heat-conduction problems.** Gartling, D.K. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 133p. NTIS, PC A07/MF A01. Order Number DE83003822.

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COYOTE is a finite element computer program designed for the solution of two-dimensional, nonlinear heat conduction problems. The theoretical and mathematical basis used to develop the code is described. Program capabilities and complete user instructions are presented. Several example problems are described in detail to demonstrate the use of the program.

12871 **(SAND—81-0510) Experimental and theoretical investigation of the reduction in parachute drag caused by forebody wake effects: data compilation and program summary.** Peterson, C.W.; Johnson, D.W. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 43p. NTIS, PC A03/MF A01. Order Number DE83005364.

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An experiment was conducted to evaluate approximate analytical methods for predicting the reduction in parachute drag caused by forebody wake effects. The drag of a 20^0 conical ribbon parachute was measured at several axial stations behind an ogive cylinder forebody with and without fins. The same parachute was tested in undisturbed flow (where wake effects were negligible) so that the effects of suspension line length on parachute drag could be separated from the drag losses caused by the turbulent wake. Total head pressure surveys were made across the forebody wake and integrated across the canopy skirt area to determine the effective dynamic pressure acting on the parachute. Experimental results confirmed the validity of the underlying physical model of the parachute/wake interaction: the ratio of parachute drag behind a forebody divided by wake-free parachute drag is equal to the ratio of effective dynamic pressure acting on the parachute divided by free-stream dynamic pressure. However, the inability of existing turbulent wake theoretical models to make accurate predictions of wake velocity distributions for arbitrary forebody shapes is a fundamental limitation of the drag-loss analysis. If wake velocity profiles are known, the empirical constants in the turbulent wake theoretical models can be adjusted and accurate estimates of wake-induced parachute drag loss can be obtained from existing theory.

12872 **(SAND—81-1390) LOVEL: a low-velocity aerodynamic heating code for flat-plates, wedges, and cones.** Thornton, A.L. (Sandia Labs., Albuquerque, NM (USA)). Dec 1981. Contract AC04-76DP00789. 23p. NTIS, PC A02/MF A01. Order Number DE82007100.

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The LOVEL computer program calculates the boundary-layer edge conditions for subsonic and supersonic flow over flat-plate, wedge, and cone geometries for freestream Mach conditions (M/sub ∞/ < 3. Cold-wall heat-transfer calculations use reference temperature correlations based on boundary-layer edge Mach number to compute fluid properties. The first part of this report describes the theory used in the computation of the cold-wall heat-transfer rates; the second part describes in detail the input/output format for the LOVEL computer program. Outputs include freestream conditions, boundary-layer edge conditions, cold-wall heat-transfer rates, plots of heating rates, and punched-card output for use in ablation and in-depth transient heat-conduction computer codes.

12873 **(SAND—82-0435) Experimental and numerical studies of natural convection in a Hele-Shaw cell.** Viney, C.E.; Hickox, C.E.; Montoya, P.C. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 60p. NTIS, PC A04/MF A01. Order Number DE83005251.

The results of an experimental study are reported in which a Hele-Shaw cell was used to simulate natural convection flow in a homogeneous porous region subjected to a horizonal temperature gradient. Measured velocities and photographs of streamline patterns are compared with numerical predictions produced with the finite element computer program, MARIAH. Results of numerical simulations are also reported for Rayleigh-Benard convection in a bottom-heated, horizontal, prous layer. The numerical results are compared with the experimental Hele-Shaw cell results of Hartline and Lister. The comparison between these experimental and numerical studies provides some support for the qualification of MARIAH as a general purpose code for the description of natural convection in porous media at low Rayleigh numbers.

12874 **Study of transition boiling phenomena with saturated water at 1-4 bar.** Wang, S.W. Cincinnati, OH; Univ. of Cincinnati (1981). 409p. University Microfilms Order No.82-01,261.

Thesis (Ph.D.).

Steady-state and transient heat transfer tests have been coupled with fundamental studies of transition boiling. These tests were conducted using the University of Cincinnati's mercury heat transfer loop. Flowing water was boiled by the hot flowing mercury in the two test sections used in this study. In the first test section, water flowed upward inside a 1.02 cm stainless steel tube heated by hot mercury flowing downward in the surrounding annulus. In the second test section, the water flowed upward in an annular space (3.8 cm OD, 2.8 cm ID) with hot mercury flowing downward in the center tube. Measurement of wall and mercury temperature at several elevations in each test section allowed the heat transfer to be determined. In essentially all the experiments conducted under this program, the water was at the saturation temperature when transition boiling began. The conclusions presented herein are limited to this condition.

12875 **(ORNL-tr—4934) Determination of local heat transfer during falling-film evaporation and condensation on fluted surfaces for the purpose of designing high-efficiency evaporators.** Schnabel, G. (Oak Ridge National Lab., TN (USA); Karlsruhe Univ. (T.H.) (Germany, F.R.)). [nd]. Contract W-7405-ENG-26. Translation source information not available . 147p. NTIS (US Sales Only). Order Number DE83005027.

Mf only; illegibility does not permit PC reproduction. Thesis.

The objective of the experimental study was to measure local heat transfer coefficients along the profile development during the evaporation of falling water and refrigerant films in double, sinusoidally fluted tubes. The measuring technique developed for this purpose uses as the heating surface a thin insulated metal foil in which a locally constant heat flux is produced by electric current. A distribution of the heat transfer coefficients is thereby mapped as wall temperature distribution. The test results show that with a given profile there is a narrow range of trickling intensity for each liquid medium in which the distribution of the local heat transfer coefficients assumes an optimum curve. In this range the heat trans-

fer coefficients on the peaks of the profile are about four times higher than the comparable values for smooth walls. In the direction of the flank or the valley, the heat transfer coefficients drop to approximately the reference values. A model used to predict the heat transfer coefficients for film condensation shows that the surface tension of the condensing medium produces extremely thin liquid films on the peaks of the profile, from which high heat transfer coefficients result. The results of the calculation method have been confirmed by recent test results. Using the distributions determined for the two heat transfer coefficients, the two-dimensional thermal conduction process inside a fluted tube wall was calculated. The calculation shows that a large portion of the heat within the wall flows from the profile ridge on the condensate side to the profile ridge on the evaporation side. Good transverse heat conduction ultimately determines the improvement of heat transfer. From the sum of local heat flows along the profile development one obtains heat transition coefficients which agree with the published test results.

4205 Materials Testing

REFER ALSO TO CITATION(S) 12518, 12670, 12701

12876 **(AERE-R—10409) Evaluation of a computer aided X-ray fluorographic system: part 1 - system analysis.** Burch, S.F.; Cocking, S.J. (UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.). Feb 1982. 42p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703372.

A computer aided, X-ray fluorographic (CAF) system has been assembled for application in non-destructive testing. The fluorographic hardware comprises a rare earth phosphor viewed with a low-light level SIT (Silicon intensifier target) TV camera, suitable for real time imaging in an industrial environment. A digital image processor allows integration to reduce noise and hence increase the thickness sensitivity. It also provides image modification for optimum visual detection of defects. Measurements of the resolution of the system and the noise on the fluorographic images are presented. Observations of wire type IQIs gave subjective thickness sensitivities of 2 to 4% for steel specimens up to 9mm thick. The observed noise was caused primarily by the camera rather than by the fundamental limit expected from X-ray photon statistics. The present system has, in practical applications, shown a capability to detect small (0.5mm) volumetric defects in castings. Further developments of the system are also discussed. It is concluded that a micro-focus X-ray set should be used with the existing hardware to investigate projection magnification fluoroscopy.

12877 **(BMFT—150-423-Pt.1) Study of flow magnitude by means of ultrasonic holography.** Schmitz, V.; Mueller, W.; Schaefer, G.; Hoppstaedter, K.; Graeber, B. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Saarbruecken (Germany, F.R.). Inst. fuer Zerstoerungsfreie Pruefverfahren). 15 Dec 1981. 107p. (In German). Dep. NTIS, PC A. Order Number DE83900588.

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A description is given of a numerical reconstruction prototype with a frequency range of 0.5 mHz and 10 mHz for two-dimensional holography for flaw detection. The Rayleigh-Sommerfield formula was found to yield better results than the Fresnel approximation. Also described is the software for reconstruction. 10 references, 62 diagrams.

12878 **(EGG-FM—6046) Coincident inspection: FY-82 report.** Johnson, J.A.; Barna, B.A. (Idaho National Engineering Lab., Idaho Falls (USA)). Sep 1982. Contract AC07-76ID01570. 18p. NTIS, PC A02/MF A01. Order Number DE83003722.

This report describes some preliminary work to develop the technology base for a concurrent welding/NDE (nondestructive evaluation) process to detect defects as they occur. If defects could be detected during each weld pass, they could be repaired with minimal metal removal and a minimum of weld metal would be used in rewelding. Welding energy requirements would also be reduced by minimizing weld repair. Ultrasonic evaluation techniques may be able to detect weld defects a short distance behind the welding head. Two potential problems are being investigated, and some possible solutions are discussed. First, how severe is the masking effect of geometric reflectors in a partially completed weld. Second, how can defects be recognized quickly enough so that repairs can be made during the welding process.

12879 **(EGG-M—15782) Flaw characterization with ultrasonic phase and frequency information.** Barna, B.A.; Lott, L.A.; Johnson, J.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 2p. (CONF-8210104—1). NTIS, PC A02/MF A01. Order Number DE83003244.

From Quality testing manufacturing (QUALTEST I) conference; Pittsburgh, PA, USA (4 Oct 1982).

Analysis of ultrasonic frequency and phase information in flaw echoes collected across a scanning aperture has shown subtle effects that are dependent on flaw configuration. These results arose from research being conducted on synthetic-aperture imaging techniques. After accounting for the gross effects in phase shifts due to the transducer sound field, a residual phase shift due to the flaw is observed. The relationship of these residual effects to flaw characteristics is explored and techniques for its measurement are detailed. Similar effects are seen in the amplitude spectra. A more-complete understanding of these phenomena may provide a powerful tool for flaw characterization beyond techniques such as synthetic-aperture imaging.

12880 **(IS-M—390) NDE programs at the Ames Laboratory and Iowa State University.** Thompson, R.B.; Thompson, D.O. (Ames Lab., IA (USA); Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Engineering Science and Mechanics). 1982. Contract W-7405-ENG-82. 7p. (CONF-820563—8). NTIS, PC A02/MF A01. Order Number DE83003790.

From 5. international conference on quantitative NDE in the nuclear industry; San Diego, CA, USA (10 May 1982).

Research and technology transfer programs in the field of nondestructive testing and the interrelationships of these activities at the Ames Laboratory and Iowa State University are discussed. Examples of the research include: measurement of the properties of a dilute distribution of pores in ceramics; the interaction of ultrasonic waves with fatigue cracks; and the development of acoustoelastic techniques for measuring elastic stresses. (LCL)

12881 **(PNL-SA—10523) Acoustic-emission linear-pulse holography.** Collins, H.D.; Lemon, D.K.; Busse, L.J. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1982. Contract AC06-76RL01830. 16p. (CONF-820765—1). NTIS, PC A02/MF A01. Order Number DE83003476.

From 12. international symposium on acoustical imaging; London, UK (19 Jul 1982).

This paper describes Acoustic Emission Linear Pulse Holography which combines the advantages of linear imaging and acoustic emission into a single NDE inspection system. This unique system produces a chronological linear holographic image of a flaw by utilizing the acoustic energy emitted during crack growth. Conventional linear holographic imaging uses an ultrasonic transducer to transmit energy into the volume being imaged. When the crack or defect reflects that energy, the crack acts as a new source of acoustic waves. To formulate an image of that source, a receiving transducer is scanned over the volume of interest and the phase of the received signals is measured at successive points on the scan. The innovation proposed here is the utilization of the crack generated acoustic emission as the acoustic source and generation of a line image of the crack as it grows. A thirty-two point sampling array is used to construct phase-only linear holograms of simulated acoustic emission sources on large metal plates. The phases are calculated using the pulse time-of-flight (TOF) times from the reference transducer to the array of receivers. Computer reconstruction of the image is accomplished using a one-dimensional FFT algorithm (i.e., backward wave). Experimental results are shown which graphically illustrate the unique acoustic emission images of a single point and a linear crack in a 100 mm x 1220 mm x 1220 mm aluminum plate.

12882 **(SAND—82-1546) Pressure-shear loading techniques for material-property studies.** Chhabildas, L.C.; Hardy, R.D. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1982. Contract AC04-76DP00789. 14p. (CONF-820872—1). NTIS, PC A02/MF A01. Order Number DE83002193.

From 33. meeting of Aeroballistic Range Association; Santa Barbara, CA, USA (18 Aug 1982).

Experimental loading techniques are described which allow a detailed study of material response under more-general loading conditions than achieved in conventional uniaxial strain experiments. These techniques allow the use of smooth bore guns to generate well-controlled one-dimensional combined pressure-shear waves in flat plates. A velocity-interferometer technique used to determine both longitudinal and shear particle velocity at the target-free surface is also described.

12883 **(SAND—82-1548C) Evaluation and control of conservatism in drop-table shock tests.** Baca, T.J. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 36p. (CONF-821040—2). NTIS, PC A03/MF A01. Order Number DE83004134.

From 53. shock and vibration symposium; Danvers, MD, USA (26 Oct 1982).

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Absolute acceleration shock specta are the most common means of characterizing mechanical shocks. These shock spectra are of limited use in making a quantitative evaluation of the conservatism contained in a laboratory shock test. This paper presents a technique for evaluating and controlling the conservatism in drop table shock tests. Alternative characterizations of shock transients are introduced which compensate for the limitations of absolute acceleration shock spectra in representing shock environments. A method of analyzing both field and laboratory shock environments is developed which can be used for any type of shock characterization to account for the variability in the description of the environments. Conservatism between the field and laboratory shock environment is then quantified in terms of the index of conservatism (IOC). The IOC can be calculated for any response characteristic of interest. This measure of conservatism possesses the attribute of incorporating information on the uncertainty in either of the shock environments. Control of the level of conservatism in a shock test in terms of a given response characterization is shown to be possible through the derivation of test modification factors associated with desired IOC values. These shock data analysis procedures are demonstrated using field and drop table shock data measured on a simple cantilever beam structure. Curves are generated showing the factor by which the amplitude of the drop table input pulse must be modified to produce the required index of conservatism.

4206 Safety Engineering

12884 **(RISLEY-Trans—4167) Reliability studies applied to plant safety.** Lovati, A. Translated from *Chimica e l'Industria (Milan)* ; **60**: No. 10, 843-846(Oct 1978). 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900032.

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In recent years, the chemical engineering sector has been engaged in introducing the concepts and methods of technological reliability into the safety analyses of process plants. The methodologies of technological reliability, as they can now be applied to the study of process plant safety are described in a systematic manner. Reliability can also be studied in order to improve the performance of a system, but its principal application is to safety. Risks are classified as conventional, specific, or major potential, with emphasis on major potential risks. Proposed and in-place regulations in the European Economic Community on the control of certain industrial activities with regard to the risks of accidents and the reporting requirements of these regulations are discussed. (LCL)

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 13552

12885 **(NBSIR—82-2552) Measurement techniques for high-power semiconductor materials and devices. Annual report, October 1, 1980-December 31, 1981.** Thurber, W.R.; Phillips, W.E.; Larrabee, R.D. (National Bureau of Standards, Washington, DC (USA)). Aug 1982. Contract AI05-81OR20849. 64p. NTIS, PC A04/MF A01. Order Number DE82021026.

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This annual report describes results of NBS research directed toward the development of measurement methods for semiconductor materials and devices which will lead to more effective use of high-power semiconductor devices in applications for energy generation, transmission, conversion, and conservation. Emphasis is on the development of measurement methods for power-device-grade silicon. Major accomplishments during this reporting period were : (1) characterizing by deep level transient spectroscopy (DLTS) the energy levels in silicon power rectifier diodes, (2) writing of a computer program to predict lifetime-related parameters using as input the measured properties of the deep energy levels, (3) developing a novel method to detect nonexponential transients using a conventional double-boxcar DLTS system, (4) analyzing transient capacitance measurements to extend the techniques to nonexponential decays, (5) using a platinum resistance thermometer to calibrate temperature sensing diodes to obtain the precision needed for careful isothermal capacitance measurements, and (6) utilizing trap changing time as a technique to resolve overlapping DLTS peaks in sulfur-doped silicon.

12886 **(SAND—82-1874C) Ga(As,P) strained-layer superlattices: a ternary semiconductor with independently adjustable band gap and lattice constant.** Gourley, P.L.; Biefeld, R.M. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 15p. (CONF-821219—2). NTIS, PC A02/MF A01. Order Number DE83003917.

From International conference on metastable and modulated semiconductor structures; Pasadena, CA, USA (6 Dec 1982).

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We have measured both the lattice constant and the optical transitions in GaP/GaAs/sub x/P/sub 1-x/ strained-layer superlattices (SLSs) as a function of composition x from x = 0 to 0.6. By comparing these results to those for the alloys GaAs/sub anti x/P/sub 1-anti x/ where anti x = x/2 corresponds to the same average compositions as the SLSs, we demonstrate for the first time in a ternary system, a semiconductor crystal with a bandgap that can be varied independently of its lattice constant.

12887 **(UCRL—88314) Wafer-scale laser lithography. I. Pyrolytic deposition of metal microstructures.** Herman, I.P.; Hyde, R.A.; McWilliams, B.M.; Weisberg, A.H.; Wood, L.L. (Lawrence Livermore National Lab., CA (USA)). 1982. Contract W-7405-ENG-48. 11p. (CONF-821107—37). NTIS, PC A02/MF A01. Order Number DE83004220.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

Mechanisms for laser-driven pyrolytic deposition of micron-scale metal structures on crystalline silicon have been studied. Models have been developed to predict temporal and spatial propeties of laser-induced pyrolytic deposition processes. An argon ion laser-based apparatus has been used to deposit metal by pyrolytic decomposition of metal alkyl and carbonyl compounds, in order to evaluate the models. These results of these studies are discussed, along with their implications for the high-speed creation of micron-scale metal structures in ultra-large scale integrated circuit systems. 4 figures.

12888 **(Y/IA—156) Improving divider calibration techniques.** Endsley, R. (Oak Ridge Y-12 Plant, TN (USA)). 1983. Contract W-7405-ENG-26. 14p. (CONF-830113—1). NTIS, PC A02/MF A01. Order Number DE83004061.

From Measurement science conference; Palo Alto, CA, USA (20 Jan 1983).

This paper describes the development of a procedure for calibration of precision voltage dividers. The procedure makes use of a reference divider made up of NBS-type resistors and a calibrated null detector. Although developed primarily for a seven-dial Kelvin-Varley divider with a span of 2111.111 units, it is adaptable to dividers with other spans. Typical results are presented along with a statistical discussion of repeatability. Advantages of the procedure are improved repeatability, increased confidence in corrections, more rapid data acquisition, and independence from NBS for divider calibration.

12889 **(LA-tr—83-2) Study of certain plane spiral deflecting systems of traveling-wave tubes.** Vainoris, Z.A.; Matseika, K.Yu.; Shtaras, S.S. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. Translated from Trudy nauchno-tekhnicheskoi konferentsii, Tom 4. Radioelektronika, 1968, pp 67-76. 13p. NTIS, PC A02/MF A01. Order Number DE83005024.

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The article studies a two-screened spiral deflecting system. It analyzes its dispersion properties, the dependence of the wave resistance on the frequency and distribution of the electric field in the cross-section for constant power transmitted. The results obtained are used in the analysis of the properties of a two-spiral deflecting system.

12890 **(LA-tr—83-1) Dispersion properties of spiral deflecting systems.** Vainoris, Z.A.; Matseika, K.Yu.; Shtaras, S.S. (Los Alamos National Lab., NM (USA)). 1983. Contract W-7405-ENG-36. Translated from Sbornik nauchnykh trudov konferentsii, Tom 3. Radioelektronika, 1967, 29-45. 19p. NTIS, PC A02/MF A01. Order Number DE83005025.

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The article analyzes the dispersion properties of spiral deflecting systems of traveling-wave electron ray tubes. It considers systems with rectangular, circular and elliptical cross-sections. The authors show that the cause of the dispersion of the phase holding time in spiral deflecting systems with homogeneous dielectric is the electromagnetic bond between the individual sections of the spiral. To reduce this dispersion we must use systems consisting of a spiral placed between two screens, while the dispersion in the systems with extensive elliptical and rectangular cross-sections is less than for circular spiral deflecting systems. In deflecting systems with different dielectrics in the internal and external regions of the spiral the dispersion may arise because of the redistribution of the electromagnetic field and its value depends on the ratio of the dielectric permeabilities and the transversal dimensions of the system. The article gives simple approximate expressions to determine the slowing down for very low and high frequencies.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 12091

4210 Combustion Systems

REFER ALSO TO CITATION(S) 11765, 12623

12891 **(AD-A—119030/5) A field test using DRDF in a spreader stoker hot water generator. Final report Sep 80-Jul 81.** Carpenter, P.F.; Kleinhenz, N.J. (Systems Technology Corp., Xenia, OH (USA)). Aug 1981. 137p. NTIS, PC A07/MF A01.

The objective of this report was to provide an evaluation of boiler performance and environmental emissions when combusting densified forms of refuse-derived fuels (dRDF) in a military scale (40 to 300 MBTUH capacity) spreader stoker fired boiler. The boiler tested was located in Building 1240, Heating Facility at Wright-Patterson Air Force Base, Ohio. The field tests were designed to investigate: the material handling characteristics of RDF; boiler performance, i.e., boiler efficiency, spreader limitations, HTHW production, combustion properties, slagging, fouling, and clickering; and, environmental emissions, i.e., electrostatic precipitator performance, particulate emissions (size, mass rate, and resistivity), gaseous emissions, and trace metal emissions. The test demonstrated that firing unblended dRDF can be performed with minimal impact on the operational performance of a military hot water generator operated at one-third of its capacity. The boiler burned well with adequate fuel burn-out and boiler response. A 3.5% percent decrease in efficiency occurred during RDF firing. There was no significant change in electrostatic precipitator removal of particulate emissions as a result of firing RDF compared with coal. Some heavy metal emissions (nickel, zinc, chromium) were higher for RDF than coal.

12892 **(AD-A—119291/3) Boiler efficiency and emissions testing using refuse-derived fuel (RDF) and coal, Wright-Patterson Air Force Base, Ohio 45433. Final report 21-26 Feb 82.** (Research Triangle Inst., Research Triangle Park, NC (USA)). Aug 1982. 54p. NTIS, PC A04/MF A01.

This report is an evaluation of boiler performance, i.e., boiler efficiency and combustion properties; and environmental emissions, i.e., electrostatic precipitator performance, particulate emissions (size and resistivity), gaseous emissions (SOx, NOx, CO and HC) and trace organics; while burning the following three fuel combinations at maximum boiler capacity; 100% coal, 40/60 refuse-derived fuel (RDF) to coal; and 100% RDF.

12893 **(NP-tr—3900769) Development of new combustion control equipment. Application to a modern range of gas burners and the resulting savings. The move towards permanent closed loop combustion control.** Lorek, G. (British Gas Corp., London; Societe pour l'Utilisation Rationnelle des Gaz, 75 - Paris (France)). [nd]. Translated from 15th World Gas Congress of the IUG, Lausanne, Switzerland, June 1982. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900769.

Portions of document are illegible.

Two types of combustion control equipment, one for premixed burners and the other for nozzle mixing burners, based on the same patented principle, are described. According to this principle, air/gas ratio is maintained by means of a simple mechanism through the motion of a single rotating organ. The low cost and small size of this equipment, coupled to its ease of use has facilitated the economic use of modern forced draught burners, both radiant and convective, alone or in groups. Substantial energy savings result from the constant air/gas ratio on installations so equipped, the safety in use being particularly appreciated by operators using manually controlled heating equipment. The addition of continuous combustion monitors to this control equipment will allow, by means of a microprocessor, an almost instantaneous compensation for changes in air quality (temperature, pressure, humidity) or gas quality (temperature, pressure, Wobbe index).

4220 Underground Engineering

REFER ALSO TO CITATION(S) 11740

4250 Power Cycles

REFER ALSO TO CITATION(S) 12622

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 11914, 12827, 13293, 13294

12894 **(BNL—32239) High energy e^+-e^- collider using an inverse free electron laser accelerator.** Pellegrini, C. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 15p. (CONF-820980—2). NTIS, PC A02/MF A01. Order Number DE83004601.

From European Committee of future accelerators - the challenge of ultra-high energies conference; Oxford, UK (27 Sep 1982).

Among the possible acceleration schemes the ones using the very large electric field obtainable in laser beams, have been receiv-

ing much attention. In this Workshop laser accelerators were divided in three groups: media, near field and far field accelerators. In the last group one finds the Inverse Free Electron Laser Accelerator (IFELA). The laser accelerator scheme is discussed, and it is shown that it can be used to design a 300 GeV electron-positron collider with a luminosity of 10^{32} $cm^{-2}s^{-1}$, and an average accelerating field between 200 and 100 MeV/m.

12895 (JINR-R—9-81-734) Deuteron cyclotron complex on the base of superconducting sector magnets. Glazov, A.A.; Denisov, Yu.N.; Dzhelepov, V.P.; Dmitrievskij, V.P.; Zaplatin, N.L.; Kalinichenko, V.V.; Kol'ga, V.V.; Onishchenko, L.M.; Mal'tsev, A.P.; Teplyakov, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703324.

Design parameters of the accelerating complex consisting of a linear accelerator-injector and two sector ring cyclotrons are presented. It permits to accelerate deuterons up to 1 GeV/nucleon energy with the 10-100 mA intensity. The continuous operating regime of the complex is provided by the common accelerating frequency for the linear and cyclic accelerators. The complex is intended for the production of intense neutron and muon beams in a wide energy range for scientific and applied purposes.

12896 (LBL—14624) RFQ development at LBL. Abbott, S.; Brodzik, D.; Gough, R.A.; Howard, D.; Lancaster, H.; MacGill, R.; Rovanpera, S.; Schneider, H.; Staples, J.; Yourd, R. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 4p. (CONF-821123—23). NTIS, PC A02/MF A01. Order Number DE83004192.

From 7. conference on the application of accelerators in research and industry; Denton, TX, USA (8 Nov 1982).

The radio frequency quadrupole (FRQ) is a structure which can efficiently focus, bunch and accelerate low velocity ion beams. It has many features which make it particularly attractive for applications in the biomedical and nuclear sciences. There are two projects in progress at LBL where the incorporation of heavy ion RFQ technology offers substantial benefits: in the upgrade of the Bevatron local injector, and in the design of a dedicated heavy ion medical accelerator. In order to meet the requirements of these two important applications, a 200 MHz RFQ structure has been designed for ions with charge to mass ratios as low as 0.14, and a low rf power scale model has been built and tested. Construction of the high power model has begun. The status of this project is reviewed and a summary of technical specifications given.

12897 (LBL—15225) Physics with linear colliders in the TeV CM energy region. Bulos, F.; Cook, V.; Hinchliffe, I.; Lane, K.; Pellet, D.; Perl, M.; Seiden, A.; Wiedemann, H. (Lawrence Berkeley Lab., CA (USA)). Jul 1982. Contract AC03-76SF00098. 12p. (CONF-8206116—15). NTIS (US Sales Only). Order Number DE83004270.

From DPF summer study on elementary particle physics and future facilities; Aspen, CO, USA (28 Jun 1982).

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From a technical point of view a linear collider of high energy and luminosity cannot be operated economically at the present date. A series of R & D efforts in different areas are required to produce the necessary technology for an economically feasible linear collider. No fundamental limits, however, have been found as yet that would prevent us from reaching the goals outlined in this report. Most of the critical component will be tested in a real like situation once the SLC comes into operation. Beyond that much R & D is required in rf-power sources to reduce the power consumption and in high gradient accelerating structures to minimize the required real estate and linear construction costs.

12898 (LA-tr—82-28) Drive for the hf quadrupole structure. Mueller, J.; Schempp, S. (Los Alamos National Lab., NM (USA); Frankfurt Univ. (Germany, F.R.). Inst. fuer Angewandte Physik). 1982. Contract W-7405-ENG-36. Translation of Int. Rep/79-1. 11p. NTIS, PC A02/MF A01. Order Number DE83001241.

Portions of document are illegible.

In earlier investigations of the rf quadrupole linac, the axial fields were measured using a given line geometry, and then the shunt impedance was determined. The four lines were excited with the help of two coupled spirals oscillating in a pi mode. In other groups, the required line potentials are obtained either by four-chamber resonators excited in a TE_{211}-type mode or by longitudinally slit double-H resonators. In comparison to these cavity resonators, a resonator structure such as the spirals has the advantage in that the resonator or line geometry essentially determining the frequency can be varied more easily. The construction used has two weaknesses: the axial adjustment of the structure hanging on the spirals is awkward; and it is unsuitable in this form for a high-power mode of operation because it lacks stability. In this paper, various types of drive using such a four-line arrangement are tested and compared. (GHT)

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 13377

12899 (BNL—32168) Workshop on acceleration of polarized protons: summary report. Lee, Y.Y.; Terwilliger, K.M. (Brookhaven National Lab., Upton, NY (USA); Michigan Univ., Ann Arbor (USA)). 1982. Contract AC02-76CH00016. 4p. (CONF-820941—9Summ.). NTIS, PC A02/MF A01. Order Number DE83003957.

From 5. international symposium on high energy spin physics; Upton, NY, USA (16 Sep 1982).

The workshop sessions concentrated on polarized protons in circular accelerators and storage rings. Topics such as polarized electrons were discussed only when the subject was relevant to proton phenomena. Of major interest was the possible applicability of the new idea of spin matching for crossing depolarizing resonances. On the experimental side, some remarkable new data were presented by the SATURNE II Group. They have successfully crossed both intrinsic and imperfection depolarizing resonances by the spin flip method with minimal depolarization-the first group to do so. They also obtained some results which apparently cannot be explained with our present understanding of spin phenomena. The workshop concluded that more experimental measurements are needed to understand the physics and that such studies would be very important for the future acceleration of polarized protons at KEK and the AGS. The workshop included status reports from the four laboratories which have programs of polarized particle acceleration--or approved projects to accelerate polarized protons.

12900 (ITEF—102(1981)) Irreversible processes in a binary system of an electron cooling channel. Batalin, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703316.

Methods of non-equilibrium thermodynamics have been used to investigate the effect of irreversible proceses arising in a single action two-component system of an electron cooling channel designed for injection in a linear proton accelerator. Irreversible processes comprise non-uniformity of temperature distribution and particle density, presennce of particle velocity gradients, presence of external field non-uniformities. For the system of combined beams (electron and proton) evaluations of thermal conductivity and dynamic friction are given. The irreversible processes effect evaluations provide the posibility to determine maximum permissible deflections of uniform distribution in the two-component system, to elucidate the existing limitations on the value of attained temperature of a cooled proton beam as well as to analyse the system behaviour at the partial beam contact.

12901 **(ITEF—107(1981)) Computation of the fields in structures with spatially-uniform quadrupole focusing for electrodes of special configuration.** Balabin, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 20p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703317.

The results of the computations of the fields in the structures with spatially-uniform quadrupole focusing for the semicircular electrodes with sinusoidal modulation are presented. These results are compared with those obtained for the ideal electrodes. The brief description of the POLE1 computer code is given. The optimum geometry (with regard to the field linearity) of the semicircular electrodes with the sinusoidal modulation is found. Calculating time for one semiperiod constitutes 7-23 min. It is shown that focusing field generated by semicircular electrodes with sinusoidal modulation has a best linearity when Rsub(e)/Rsub(a) approximately 1.14 where Rsub(e) is the radius of electrode and Rsub(a) - the axis to electrode distance.

12902 **(JINR-R—9-81-664) Magnetic field shaping for the JINR phasotron.** Alenitskij, Yu.G.; Zaplatin, N.L.; Ivashkevich, S.A.; Morozov, N.A.; Onishchenko, L.M.; Chesnova, S.I.; Shishlyannikov, P.T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703321.

The shaping of the magnetic field of the JINR high current phasotron is given. The purpose of this investigation was to obtain the required law for the mean magnetic field and required accuracy for the low number harmonics amplitudes. The magnetic system and trimming elements for high current phasotron are described. The data obtained for all magnetic system assembly tolerances are presented. The magnetic field data are estimated. The shaping of the magnetic field resulted in deviation of +-15 G in a mean magnetic field for $r > 20$ cm and the low number harmonics amplitudes were less than 10 G for all radiuses. The vertical focusing of charged particles is realised by means of the magnetic field spatial variation.

12903 **(JINR-R—9-81-809) Magnetic system of induction section for accelerating an electron-ion ring.** Kazacha, V.I.; Kozhukhov, I.V.; Kosukhin, V.V.; Prejzendorf, V.A.; Sidorov, A.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703325.

A system for forming the leading magnetic field of the induction accelerating section of a collective accelerator prototype is considered. The system consists of magnetic field coils, positioned inside of LIU-3000 inductors, two matching solenoids situated by sides of the accelerating section and of their power supply system. Basing on the calculations performed parameters of the magnetic field coils were chosen and necessary modifications in the design of the inductors were made. Schemes of power supply of the coils of matching solenoids and of the accelerating section and amplitude values of their currents were obtained. The measurements showed a good agreement between calculated values of the leading magnetic field and experimentally obtained results. It is succeeded in matching the magnetic field of the accelerating section with the magnetic field of the solenoid for preliminary acceleration and in forming the Bsub(Z)approximately equal to 1T magnetic field over the whole length of the accelerating section.

12904 **(JINR-R—11-81-813) Convergence of a difference approximation of self-consistent system of Maxwell equations on a class of discontinuous solutions.** Kadantseva, E.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703319.

The stability and convergence of a numerical solution of self- consistent problem is investigated, which appears when computing electromagnetic fields in the collection accelerator resonator. The corresponding group of Maxwell equations and relativistic Newton equation of motion is solved by the finite-difference method. Inhomogeneous domain Ω is considered. The finite number of a piecewise smooth lines of discontinuity of first derivatives of solution are assumed. Outside the discontinuity lines the first derivatives are continuously. It is shown that the natural restriction on the steps is sufficient for the stability of the finite-difference approximation of self-consistent problem.

12905 **(LA—9570-MS) Inductive-wall and longitudinal space-charge impedances in LAMPF II.** Rees, G.H. (Los Alamos National Lab., NM (USA)). Nov 1982. Contract W-7405-ENG-36. 6p. NTIS, PC A02/MF A01. Order Number DE83003997.

The inductive-wall and longitudinal space-charge impedances of LAMPF II are calculated. These effects are small below transition, but may require additional rf in order to achieve the desired energy gain per turn late in the accelerator cycle.

12906 **(LA-UR—82-3267) High-brightness negative-hydrogen linear accelerator.** Wadlinger, E.A.; Farrell, J.A.; Dogliani, H.O. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 17p. (CONF-821123—28). NTIS, PC A02/MF A01. Order Number DE83003565.

From 7. conference on the application of accelerators in research and industry; Denton, TX, USA (8 Nov 1982).

We have designed a linear accelerator to accelerate negative hydrogen ions to 50 MeV with an instantaneous output current of 100 mA and a normalized rms emittance in both transverse planes of 0.02 π cm mrad. The design and results obtained to date with a 2-MeV prototype are presented.

12907 **(LBL—15089) Antiproton production and accumulation for a 20-TeV anti pp collider.** Lambertson, G.R.; Leemann, C.W. (Lawrence Berkeley Lab., CA (USA)). Oct 1982. Contract AC03-76SF00098. 5p. (CONF-8206116—17). NTIS, PC A02/MF A01. Order Number DE83003759.

From DPF summer study on elementary particle physics and future facilities; Aspen, CO, USA (28 Jun 1982).

Stochastic cooling is capable of providing a flux of 3.10^8 anti p/second, adequate to fill a 20 TeV collider in 12 hours for operation at luminosity $L = 10^{33}$ cm^{-2} s^{-1}. This represents an order of magnitude improvement over the FNAL-source design goal. It is made possible mainly due to higher bandwidth (4 GHz vs 1 GHz) and a lower psi/sub max//psi/sub max/ ratio (350 vs 10^4). Systems operating in the 4 to 8 GHz band are necessary, a technology which goes beyond the 2 to 4 GHz systems presently under development, but appears within reach with a moderate R and D effort. Stochastic cooling in the 8 to 16 GHz range holds the promise of small transverse emittance ($\lesssim$ 1 μm normalized), allowing even shorter filling times or the use of lower field, larger circumference colliders, should such devices prove more cost-effective.

12908 **(UCID—19639) Gaussian-profile beams.** Lee, E.P. (Lawrence Livermore National Lab., CA (USA)). 3 Nov 1982. Contract W-7405-ENG-48. 26p. NTIS, PC A03/MF A01. Order Number DE83004449.

The growth rate of the hose instability is derived for a beam with Gaussian radial profile, using the spread mass model of phase mix damping. It is found that the maximum growth rate of a convecting wave packet is 49% larger than that derived for a beam with the Bennett profile, and the inverse group velocity (dz/d tau) is also increased by about this amount. A general discussion of spread mass models is presented along with an explanation of the regurgitation phenomena seen in their numerical treatment.

12909 **(UCRL—87760) Radioactive ions beams for studying astrophysical nuclear reactions.** Haight, R.C.; Mathews, G.J.; White, R.M.; Aviles, L.A.; Woodard, S.E. (Lawrence Livermore National Lab., CA (USA)). 4 Nov 1982. Contract W-7405-ENG-48. 5p. (CONF-821123—26). NTIS, PC A02/MF A01. Order Number DE83004310.

From 7. conference on the application of accelerators in research and industry; Denton, TX, USA (8 Nov 1982).

Beams of radioactive ions can be produced as secondary beams following the interaction of conventional accelerator beams with suitable targets. For example we have used beams of ^{7}Li and

^{13}C from an EN Tandem Van de Graaff accelerator to produce beams of ^{7}Be and ^{13}N via the (p,n) and (d,n) reactions respectively. These beams are focused by a system of magnetic quadrupole lenses to a secondary target. Reactions of such nuclides, especially proton capture and (p,α) reactions, are of interest in solar physics and in the CNO multi-cycle in massive stars. Progress toward the measurement of these reactions is discussed.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 12865, 12909, 12947, 12993, 13297

12910 **(BNL—32169) Research using synchrotron radiation at the National Synchrotron Light Source.** Thomlinson, W. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 4p. (CONF-821123—27). NTIS, PC A02/MF A01. Order Number DE83003956.

From 7. conference on the application of accelerators in research and industry; Denton, TX, USA (8 Nov 1982).

Portions of document are illegible.

The National Synchrotron Light Source (NSLS) is now becoming operational with synchrotron radiation experiments beginning on the 700 MeV VUV electron storage ring. Commissioning of the 2.5 GeV x-ray storage ring has also begun with the experimental program expected to begin in 1983. The current status of the experimental program and instrumentation and the plans for future developments, will be discussed. Although some early results have been obtained on VUV beam lines no attempt will be made in this paper to describe them. Instead, an overview of the beam line characteristics will be given, with an indication of those already operational. In the oral presentation some initial experimental results will be discussed.

12911 **(BNL—32173) General-purpose stepping motor-encoder positioning subsystem with standard asynchronous serial-line interface.** Stubblefield, F.W.; Alberi, J.L. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 9p. (CONF-821011—26). NTIS, PC A02/MF A01. Order Number DE83004634.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

A general-purpose mechanical positioning subsystem for open-loop control of experiment devices which have their positions established and read out by stepping motor-encoder combinations has been developed. The subsystem is to be used mainly for experiments to be conducted at the National Synchrotron Light Source at Brookhaven National Laboratory. The subsystem unit has been designed to be compatible with a wide variety of stepping motor and encoder types. The unit may be operated by any device capable of driving a standard RS-232-C asynchronous serial communication line. An informal survey has shown that several experiments at the Light Source will use one particular type of computer, operating system, and programming language. Accordingly, a library of subroutines compatible with this combination of computer system elements has been written to facilitate driving the positioning subsystem unit.

12912 **(BNL—32237) Production of spallation radionuclides for medical applications at BLIP.** Mausner, L.F.; Richards, P. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 4p. (CONF-821123—22). NTIS, PC A02/MF A01. Order Number DE83004590.

From 7. conference on the application of accelerators in research and industry; Denton, TX, USA (8 Nov 1982).

The Brookhaven LINAC Isotope Producer (BLIP) is the first facility to demonstrate the capability of a large linear accelerator for efficient and economical production of difficult-to-make, medically useful radionuclides. It utilizes the excess beam capacity of a LINAC that injects 200-MeV protons into the 33-GeV Alternating Gradient Synchrotron. The LINAC provides an integrated beam current of 60 μA for radionuclide production, operating 24 hours per day, 7 days per week. The 200-MeV proton energy is very suitable for isotope production since the spallation process provides a route to copious quantities of radionuclides unavailable at lower energy accelerators, or reactors. Further, the energy is high enough to allow simultaneous irradiation of multiple targets leading to reduced cost per nuclide. Careful choice of target position in the array makes it possible to select the proper proton energy range to maximize the yield of a particular nuclide from a given target and minimize the amounts of undesirable by-products.

12913 **(BNL—32304) High-resolution x-ray scattering.** Moncton, D.E.; Brown, G.S. (Brookhaven National Lab., Upton, NY (USA); Bell Labs., Murray Hill, NJ (USA); Stanford Univ., CA (USA). Stanford Synchrotron Radiation Lab.). 1982. Contract AC02-76CH00016. 24p. (CONF-820839—6). NTIS, PC A02/MF A01. Order Number DE83004599.

From International conference on X-ray and VUV synchrotron radiation instrumentation; Hamburg, F.R. Germany (9 Aug 1982).

Beamline and spectrometer instrumentation for high-resolution x-ray scattering at the Stanford Synchrotron Radiation Laboratory is described. The combination of photon intensity at the sample of $\sim 10^{13}$ photons/sec/10 mm^2 and the momentum-transfer resolution of $\Delta Q \sim 10^{-4}$ A^{-1} make this a unique facility. Examples are given of data obtained on two-dimensional phase transitions both in studies of thin (2 molecular layers) liquid-crystal films and rare-gas monolayers on pyrolytic-graphite substrates.

12914 **(CERN—82-05) Radiation-resistent magnets.** Keizer, R.L.; Mottier, M. (European Organization for Nuclear Research, Geneva (Switzerland)). 4 Jun 1982. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703315.

This is a survey of the present state of the art in the construction of radiationresistant electromagnets, particularly for particle accelerators. A brief introduction on the electrical, mechanical, and radiochemical requirements of magnet coils is followed by the outline of a mathematical model for coil design. Details are then given of the properties of the main types of material used: inorganic cements and potting compounds, compacted metal oxides, melt spraying, high-alumina cement, asbestos cement, anodized pure aluminium. Some specific applications of the different materials are described and a detailed account is given of the techniques of magnet construction developed at CERN using concrete-impregnated asbestos.

12915 **(DOE/ER/02408—209) Energy calibration of the TUNL dual-90° magnet analyzing system.** Wilkerson, J.F.; Clegg, T.B.; Ludwig, E.J. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy; Triangle Universities Nuclear Lab., Durham, NC (USA)). 1981. Contract AS05-76ER02408. 29p. (ORO—2408-209). NTIS, PC A03/MF A01. Order Number DE83004559.

An energy calibration of the dual-90° magnet momentum analyzing system has been completed for proton beams spanning the energy range of 1.9 to 14.2 MeV. The absolute calibration points used, resulted from measurements of both (p,n) thresholds and narrow (p,p) resonances. The calibration measurements were made during several separate experimental runs over a time period of approximately 1-1/2 years. Through careful monitoring of the system parameters and by using consistent magnet recycling procedures, the calibration allows accurate measurements of beam energies to within +- 2 keV. The dual-90° magnet system was determined to have a non-constant energy-to-frequency relationship for low magnetic fields.

12916 **(DOE/ER/10946—3) Sizes and shapes of short-lived nuclei via laser spectroscopy. Progress report, January 31, 1981-July 31, 1982.** Lewis, D.A. (Iowa Univ., Iowa City (USA)). Oct 1982. Contract AC02-79ER10496. 21p. NTIS, PC A02/MF A01. Order Number DE83004379.

During the time period covered by this report, significant progress has been made with the laser spectroscopy system and He-jet scattering/atomic beam chamber. These are now coupled with the latter installed on a beamline of the Argonne Superconducting Linac-Booster. A light collection chamber for eventual fast-beam work has been designed and built.

12917 (FERMILAB/TM—1148) Structural analysis of the CDF transporter cart. Leininger, M. (Fermi National Accelerator Lab., Batavia, IL (USA)). 17 Nov 1982. Contract AC02-76CH03000. 38p. NTIS (US Sales Only). Order Number DE83004555.

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The transporter cart serves as a dolly to move the large toroids (539 tons) and the Roman arches (600 tons) which are part of the central detector. ANSYS has been used to compute deflections and stresses in this cart.

12918 (IFVE-OEA—81-170) FORTRAN preprocessor in the booster synchrotron control system. Balakin, S.I.; Voevodin, V.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703395.

The FORTRAN preprocessor in the booster synchrotron automation control system realized as a macroprocessor is described. The note deals with nonstandard input/output (I/0) and using of data bank by the preprocessor are considered. The input text is in FORTRAN comprising special operators (macrocalls) which can be considered as additional language operators. The output text is prepared for the compiler in the FORTRAN standard langauge of the EC-1010 computer. Operators using possibilities of the specialized operating system are presented.

12919 (INFN/TC—82/8) Conceptual design of the electronic controls for the RF cavity of the Milan Superconducting Cyclotron. Pagani, C.; Venturini, V. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)). 11 Jun 1982. 8p. (CONF-8206144—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900840.

From 19. European cyclotron progress meeting; Grenoble, France (10 Jun 1982).

This paper presents the conceptual design of the RF phase and amplitude control systems. A new approach is proposed and its major features are briefly discussed.

12920 (JINR—9-81-682) Study on the supercyclotron cavity model excitation. Glazov, A.A.; Zaplatin, E.N.; Kochkin, V.A.; Onishchenko, L.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703318.

Investigation of a model of cavity and coupling system is performed. The cavity is a rectangular parallelepiped with inner special form protrusions in a median plane. Feeding of the model is performed by several loops, each coupled with its amplifier. The experimental results are compared with theoretical ones.

12921 (JINR—13-81-782) Facility for measurements of fragmentation spectra of relativistic deuterons and alpha particles. Ableev, V.G.; Avramenko, S.A.; Vorob'ev, G.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703366.

The modified ALPHA spectrometer on-line with the ES-1010 computer is described. Some problems of momentum spectra measuring of relativistic nuclear fragments in a wide momentum region including the cumulative one are discussed. After the interaction of a high intensity (up to $5x10^{10}$ part/s) beam of relativistic nuclei with a target the resulting fragments are separated from the beam by using a bending magnet and are directed into the magnetic spectrometer to analyse their momentum and velocity. The proportional chambers, scintillation and threshold Cherenkov counters are used. To monitor parameters of the beam a duplex connection between the computer the accelerator and the computer of the slow beam extraction system has been realized.

12922 (JINR-R—9-81-639) Study on laser plasma as a source of multicharged ions for cyclotrons in the light element range (Li,Be,C). Anan'in, O.B.; Bykovskij, Yu.A.; Gusev, V.P.; Kozyrev, Yu.P.; Kolesov, I.V.; Pasyuk, A.S.; Peklenkov, V.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703320.

The purpose of the present study is experimental investigation of the ion component of laser plasma produced in a transverse magnetic field. The laser plasma is studied in order to develop an ion source for the cyclotron. The investigations performed on the Li, Be, C targets have shown that for $4x10^9$ Wt/cm^2 radiation power density of CO_2 laser in (0.1-0.2)T magnetic fields the spectrum of ions produced in a laser source extends from singly charged ions to Li^{3+}, Be^{4+}, C^{6+} nuclei. The data on times of emissing from the source of various charge ions and on ion number are given. It has been found that the lifetime of laser plasma ion components when passing in magnetic fields distances of several centimetres reaches the value of several μc which is very important from the viewpoint of using the highly charged ion component for acceleration.

12923 (JINR-R—9-81-685) Investigation of ionization efficiency in the "Krion-1" electron-beam source. Vadeev, V.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703322.

The interaction efficiency of an electron beam with an ion target is studied using "Krion-1". The interaction efficiency has been determined by comparing the evolutions of the spectra of nitrogen ion charges obtained at different compensations of the space charge of the electron beam by ions and at various values of the magnetic field. It has been found that the interaction of the ion target with the electron beam increases significantly with decreasing the compensation of the space charge of the electron beam by ions and with growing the magnetic field. In the range of small compensations the dependence is stronger. From the results obtained it follows that in the course of ionization the ions do not acquire a considerable energy and the ion target occupies a central part of the electron beam.

12924 (KFTI—81-40) System for measuring of proton polarization in polarized target. Derkach, A.Ya.; Lukhanin, A.A.; Karnaukhov, I.M.; Kuz'menko, V.S.; Telegin, Yu.N.; Trotsenko, V.I.; Chechetenko, V.F. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1981. 31p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703367.

Measurement system of proton polarization in the target, which uses the method of nuclear magnetic resonance is described. To record the signal of NMR-absorption a parallel Q-meter of voltage with analogous subtraction of resonance characteristics of measurement circuit is used. To obtain gradual sensitivity of the system to polarization state in the whole volume of the target the measurement coils is made of tape conductor. The analysis and mathematical modelling of Q-meter are carried out. Corrections for nonlinearity and dispersion are calculated. Key diagrams of the main electron blocks of Q-meter are presented. The system described operates on line with the M6000 computer. Total error of measurement of polarization value of free protons in the target does not exceed 6%.

12925 (LBL—14623) Advanced medical accelerator design. Alonso, J.R.; Elioff, T.; Garren, A. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 4p. (CONF-821123—24). NTIS, PC A02/MF A01. Order Number DE83004191.

From 7. conference on the application of accelerators in research and industry; Denton, TX, USA (8 Nov 1982).

This report describes the design of an advanced medical facility dedicated to charged particle radiotherapy and other biomedical applications of relativistic heavy ions. Project status is reviewed and some technical aspects discussed. Clinical standards of reliability are regarded as essential features of this facility. Particular em-

phasis is therefore placed on the control system and on the use of technology which will maximize operational efficiency. The accelerator will produce a variety of heavy ion beams from helium to argon with intensities sufficient to provide delivered dose rates of several hundred rad/minute over large, uniform fields. The technical components consist of a linac injector with multiple PIG ion sources, a synchrotron and a versatile beam delivery system. An overview is given of both design philosophy and selected accelerator subsystems. Finally, a plan of the facility is described.

12926 **(LYCEN—8134) Isotopic separation device on-line with a heavy ion accelerator.** Plantier, Andre. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire; Lyon-1 Univ., 69 (France)). May 1981. 93p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82703326.

Thesis.

This work is concerning the design of an isotopic separation device on-line with an heavy-ion accelerator. The type of the separator and the Bernas-Nier type source are first described. The application of this technique to the off-line and on-line separation of activities produced with alpha and proton accelerators is then presented. It is shown how the production of isotopes far from stability can be improved using heavy-ion reactions. Alterations supplied to the ion source in order to suit it to those reactions are reported. The performances of the separator + integrated source-target facility on line with the Grenoble cyclotron are given for a set of target-projectile systems. The production rates of elements Ag, Cd, In, Sn, Sb, Te, I, Xe, Cs and Ba have been measured. Moreover those experiments lead to the identification of a new indium isotope (^{102}In with half-life of 24 seconds). Prospects of the coupling of a Helium-jet recoil transport system to the isotope separator is approached.

12927 **(LYCEN—8149) Analysis of the spectrometer SPES 4 and study of an associated detection apparatus.** Foessel, P. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire; Lyon-1 Univ., 69 (France)). Sep 1981. 78p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82703369.

Thesis.

The 4 GeV/c magnetic spectrometer SPES 4 recently set-up at Saturne National Laboratory is described. Its caracteristics are presented. Monte-Carlo simulation is used for the calculation of its transmission; it takes into account the effects introduced by the crossing of the particles through the matter as, for example, target or counters. A detection apparatus from proton up to ^{20}Ne between 1 and 4 GeV/c/Z in the momentum width of +- 4.5% is proposed. The rigidity determination is coupled with a time-of-flight and a energy loss measurement. Some experimental results are given.

12928 **(NIIEFA-P-FD—0531) Determination of energetic parameters of the beam of the EhGP-10-P charge-exchange electrostatic accelerator.** Bortnyanskij, A.L.; Graevskij, A.I.; Mikhajlov, V.D. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1981. 38p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703327.

The technique and equipment for measuring energy parameters of the beam of the EhGP-10-P charge-exchange electrostatic accelerator are developed. The analysing magnet constant and its variation with energy are determined. The reproducibility and stability of average energy of accelerated protons are investigated. The beam energy non-uniformity is measured. Investigations have been carried out using the $Al^{27}(p, \alpha)Mg^{24}$ reaction. The proton beam current has been maintained in the range of 0.5-2 μA. When determining the energy of accelerated protons the method of $Al^{27}(p, \alpha)Mg^{24}$ threshold nuclear reactions and the method using kinematic relations in nuclear interactions have been employed. The energy determination accuracy constitutes $3.4x10^{-4}$. The reproducibility of average energy of the beam has been determined by the position of the beam trajectory in the analyzer magnetic field and distribution reproducibility of the magnetic field. It has been found that the energy reproducibility can be achieved not worse than 0.009%. The magnetic analyzer constant has been determined $K=(59, 55+-0.02)x10^{-3}$ MeVxe/MHz^2. In the 3-10 MeV energy range its variations do not exceed 0.33%.

12929 **(NP—3900842) TRIUMF: scientific activities annual report, 1980.** (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Jan 1982. 134p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83900842.

Portions of document are illegible.

Several impressive projects were brought to fruition during 1980. Of noteworthy mention for expanding TRIUMF's capabilities is the successful completion of the M11 fast pion channel for physics research and beam line 2C for radioisotope research. For the first time over 100,000 μAh of proton beam (3.6 mg of protons) was produced by the cyclotron to satisfy both the pure and applied research programs and, with beam line 2C, the cyclotron has now demonstrated its capability of routinely extracting three independent beams of differing energies and intensities: a Canadian first and testament to the dedicated efforts of TRIUMF staff. The increasing tempo of the research programs can be measured by the necessity of purchasing a VAX 11/780, to expand the computing power available to experimenters at the main site. TRIUMF was honoured in early spring by a visit of H.R.H. the Prince of Wales who ceremonially initiated the flow of radioisotopes from the recently completed hot cells of the Atomic Energy of Canada Ltd. (AECL). The hot cells will allow the safe preparation of radiopharmaceuticals from cyclotron-produced radioisotopes for worldwide distribution to complement AECL's reactor-based products. The applied program scored further noticeable successes during the year as the number of 100 μA runs increased and commissioning began on radioisotope production facilities on beam lines 1A and 2C.

12930 **(ORNL/CSD/TM—191) Database automation of accelerator operation.** Casstevens, B.J.; Ludemann, C.A. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE83005151.

Database management techniques are applied to automating the setup of operating parameters of a heavy-ion accelerator used in nuclear physics experiments. Data files consist of ion-beam attributes, the interconnection assignments of the numerous power supplies and magnetic elements that steer the ions' path through the system, the data values that represent the electrical currents supplied by the power supplies, as well as the positions of motors and status of mechanical actuators. The database is relational and permits searching on ranges of any subset of the ion-beam attributes. A file selected from the database is used by the control software to replicate the ion beam conditions by adjusting the physical elements in a continuous manner.

12931 **(SAND—82-2393) Sandia nuclear microprobe.** Doyle, B.L.; Wing, N.D. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01. Order Number DE83005363.

A nuclear microprobe analysis system attached to Sandia's EN tandem Van de Graaff accelerator is described. A magnetic quadrupole doublet lens is used for the final focus and 2-μm beam diameters have been obtained. Several illustrative applications of the microprobe, including the first three-dimensional concentration profiles using Rutherford backscattering and elastic recoil detection ever measured, are given.

12932 **(SLAC-PUB—2963) Recent results from the MAC and MARK II detectors at PEP.** Dorfan, J. (Stanford Linear Accelerator Center, CA (USA)). Aug 1982. Contract AC03-76SF00515;AC02-76ER02114;AC02-76ER00881. 30p. (CONF-8206136—2). NTIS, PC A03/MF A01. Order Number DE83004155.

From Conference on physics in collision; Stockholm, Sweden (2 Jun 1982).

Data from PEP are presented for the MAC and MARK II detectors. All data are at a center-of-mass energy of 29 GeV and correspond to a data set varying from 15 to 30 pb^{-1}. R = σ/sub hadronic//σ/sub $\mu\mu$/ is presented by both groups, and inclusive momentum distributions [S(d σ/dx)] for SPEAR and PEP energies are presented by the MARK II. The S(d σ/dx) distributions exhibit sizeable scaling violations. Both groups have measured energy-

energy correlations. The measurements yield $\alpha/\sub{s}/ = 0.20 +- 0.01 +- 0.02$ (MAC) and $\alpha/\sub{s}/ = 0.19 +- 0.01 +- 0.03$ (MARK II) where $\alpha/\sub{s}/$ is the strong coupling constant to first order. It is stressed however that this measurement of $\alpha/\sub{s}/$ is a very sensitive to nonperturbative (fragmentation) effects. The MARK II group has observed a·clean D/sup *+-/ signal from which they obtain $\sigma(D/\sup{*+-/}) = 0.25 +- 0.10$ as the cross section for producing a charged D* at 29 GeV. The charm fragmentation function is measured and it appears to be fairly hard with an average fractional energy for the D^{*+-} of ~ 0.6. The MAC group has measured the tau lifetime and finds a value $t/\sub{tau}/ = (4.9 +- 2.0) \times 10^{-13}$ secs. The MARK II group has measured the tau branching fractions into one (B_1) and three ($B_3 = 1 - B_1$) charged prongs. They find $B_1 = (86 +- 3 +- 1)\%$. They also find $B_5 < 0.5\%$ at the 90% confidence level. Also presented from the MARK II group are limits on the production of charged scalar particles (Higgs or technipions; H +-) which couple to tau's. For $2 < H +-$ mass < 10 GeV/c^2, the branching fraction for H +- to decay to tau nu/sub tau/ is found to be less than 5% at the 90% confidence level. 32 references.

12933 **(SLAC-TN—82-3) Vacuum pipe for e^+e^- interactions.** Hoard, C.T. (Stanford Linear Accelerator Center, CA (USA)). Oct 1982. Contract AC03-76SF00515. 11p. NTIS, PC A02/MF A01. Order Number DE83004153.

The design, fabrication and testing of the beryllium vacuum chamber within the Mark II detector at SLAC is described. The Be chamber encloses one interaction point of the PEP circulating ring and is a part of its beam pipe. The Be chamber is captured within the Secondary Vertex Detector (SVD), a drift chamber, which is in turn centered in the Mark II drift chamber. Both ends of the beryllium pipe are brazed to aluminum/stainless transitions for connection to stainless steel bellows. A concentric radiation-screen liner of titanium foil runs the full length of the beryllium pipe.

12934 **(UCRL—87768) Low-energy-positron production at the Livermore linac.** Howell, R.H.; Alvarez, R.A.; Woodle, K.A.; Dhawan, S.; Egan, P.O.; Hughes, V.H.; Ritter, M.W. (Lawrence Livermore National Lab., CA (USA); Yale Univ., New Haven, CT (USA). Gibbs Lab.). 1 Nov 1982. Contract W-7405-ENG-48. 5p. (CONF-821123—30). NTIS, PC A02/MF A01. Order Number DE83004301.

From 7. conference on the application of accelerators in research and industry; Denton, TX, USA (8 Nov 1982).

Beams of monoenergetic positrons with energies of a few eV to many keV have been used in experiments in atomic physics, solid state physics and materials science. The results of some of these experiments are given and the production of positron beams from a new source, an electron linac, is described. Intense, pulsed beams of low-energy positrons have been produced by a high-energy beam from an electron linac. The production efficiency for low-energy positrons has been determined for electrons with energies from 60 to 120 MeV. Low-energy positron beams produced with a high energy electron a linac can be of much higher intensity than those beams currently derived from radioactive sources. These higher intensity beams will make possible positron experiments previously infeasible.

12935 **Beam Intensity Monitor (accelerator drift section) (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2776). Contract AC03-76SF00515.

20 aperture cards.

Construction and installation data are provided for the beam intensity monitors used in each drift section of the SLAC two-mile linear accelerator. These devices provide electrical signals used to help control the beam as well as measure the current at each drift section of the accelerator.

12936 **SLAC Touch Panel Model 4 (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2778). Contract AC03-76SF00515.

13 aperture cards.

Construction information is provided for the SLAC touch panel Model 4. This device, when properly connected to a computer with a program can be used to control various devices remotely. The panel only requires a touch at the proper spot to operate a given control or device as indicated by the figures or outlines. (GHT)

4304 Storage Rings

REFER ALSO TO CITATION(S) 12864

12937 **(BNL—32087) Brookhaven free-electron laser experiment.** Krinsky, S.; Luccio, A.; Pellegrini, C.; van Steenbergen, A.; Yu, L.H. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 3p. (CONF-820988—3). NTIS, PC A02/MF A01. Order Number DE83002840.

From Free electron laser conference; Bendor, France (26 Sep 1982).

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The status of the free-electron laser experiment at Brookhaven is reported, with the description of the permanent undulator already built and ready to be installed on the VUV storage ring.

12938 **(BNL—32167) Final design and status of the NSLS vacuum system.** Schuchman, J.C. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 17p. (CONF-821111—20). NTIS, PC A02/MF A01. Order Number DE83003961.

From 29. national symposium on American Vacuum Society; Baltimore, MD, USA (16 Nov 1982).

We describe the final system, as built, reasons for changes and the general status of the NSLS. The NSLS is a dedicated facility for the purpose of producing synchrotron radiation. It consists of an electron linac-booster injector system, and two storage rings, one for uv research and the other for x-ray research. (Synchrotron radiation is produced by accelerating electrons in the storage rings.) The design current and energies are 1000 ma at 700 MeV for the vuv ring and 500 ma at 2.5 GeV for the x-ray ring. A total of 44 experimental beam ports are available for use. Since each beam port may be divided into two or more experimentall beam lines, it is quite plausible to have upward of 100 simultaneously operating beam lines.

12939 **(BNL—32175) Experiment control and data-acquisition system for the biology small-angle x-ray-scattering station.** Stubblefield, F.W.; Alberi, J.L. (Brookhaven National Lab., Upton, NY (USA)). Oct 1982. Contract AC02-76CH00016. 7p. (CONF-821001—37). NTIS, PC A02/MF A01. Order Number DE83004631.

From STTFUA high-intensity solar flux measuring techniques workshop; Albuquerque, NM, USA (26 Oct 1982).

An experiment control and data acquisition system for experiments to be conducted at the Biology Small-Angle X-ray Scattering Station at the National Synchrotron Light Source is under development. The primary function of the system is to acquire and record x-ray diffraction patterns in time-slice (or time-frame) mode, where the basic average rate of data collection is 10^6 detected photons/second and the biological process under study can be divided up into ~ 10^1 to 10^3 separate time slices. Furthermore, the system must provide external sample stimuli which bring about the biological process and must coordinate these stimuli with the time slices. A multiprocessor system has been designed. The principle behind the system design is to use a commercially available computer system to perform the standard functions associated with experiment control and data acquisition, while partitioning off the non-standard functions onto auxiliary computer processors. This technique has led to a four-processor system in which interprocessor communication is accomplished by means of multiported shared memory module. A discussion of the computer system components, both hardware and software, which make up the system is presented. The description of hardware includes the processors, peripheral devices, and special-purpose hardware components present in the system; the software description covers the computer programs, operating systems, and special-purpose software which execute within the system itself and extends to a brief description of the software utilized to develop experiment control and data acquisition programs for execution on the system. The trends in computer system

components and the design philosophy which led to the present choice of components and system structure are emphasized.

12940 **(SLAC-PUB—2986) Physics with the MAC detector.** Ford, W.T.; Read, A.L. Jr., Smith, J. G. (Colorado Univ., Boulder (USA). Dept. of Physics; Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati; Northeastern Univ., Boston, MA (USA). Dept. of Physics; Stanford Univ., CA (USA); Utah Univ., Salt Lake City (USA). Dept. of Physics; Wisconsin Univ., Madison (USA). Dept. of Physics). Oct 1982. Contract AC03-76SF00515. 7p. (CONF-820718—24). NTIS, PC A02/MF A01. Order Number DE83004417.

From 21. international conference on high energy physics; Paris, France (29 Jul 1982).

New results, obtained during the previous year at the PEP colliding beam rings with the MAC detector at a center of mass energy of 29 GeV, are presented.

12941 **(SLAC-Trans—0199) Geodetic control surveys at PETRA, 1981/1982.** Loffler, F. (Stanford Linear Accelerator Center, CA (USA); Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Sep 1982. Contract AC03-76SF00515. Translation of DESY M-82-15, June 1982. 48p. NTIS, PC A03/MF A01. Order Number DE83004170.

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The following geodetic report deals with the geodetic measurements in 1981, which lead to the radial and vertical positions of the PETRA-magnets. Least square fits give the amplitudes of the harmonic deviations of the quadrupoles with respect to the ideal positions. Furthermore the movements of the magnets since 1980 are investigated.

44 INSTRUMENTATION

REFER ALSO TO CITATION(S) 12838

12942 **(SERI/TP—215-1758) Challenge for metrology in the R and D environment.** Wells, C.V. (Solar Energy Research Inst., Golden, CO (USA)). Oct 1982. Contract AC02-77CH00178. 16p. (CONF-821028—2). NTIS, PC A02/MF A01. Order Number DE83003101.

From National conference of Standards Laboratories; Gaithersburg, MD, USA (4 Oct 1982).

Portions of document are illegible. Printed copy available until stock is exhausted.

Every research and development (R and D) laboratory and its associated metrology program are a unique combination of factors that shape their relationship and affect the quality of the research measurements. This paper identifies some factors that impact the challenge to implement an effective metrology program in an R and D environment. Two suggestions are offered toward establishing or improving metrology in the R and D setting: produce a series of statements that may form an approach to developing an effective policy regarding research measurement quality and metrology in the R and D environment; and assist in planning for the measurement aspects during research experiment planning and design phases.

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 11939, 12367, 12398, 12731, 12818, 12921, 12927, 12933, 13042, 13044, 13372, 13385, 13393, 13394, 13395, 13565

12943 **(BNL—32208) Charge collection in silicon strip detectors.** Kraner, H.W.; Beuttenmuller, R.; Ludlam, T.; Hanson, A.L.; Jones, K.W.; Radeka, V.; Heijne, E.H.M. (Brookhaven National Lab., Upton, NY (USA); European Organization for Nuclear Research, Geneva (Switzerland)). Nov 1982. Contract AC02-76CH00016. 10p. (CONF-821011—39). NTIS, PC A02/MF A01. Order Number DE83004603.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

Portions of document are illegible.

The use of position sensitive silicon detectors as very high resolution tracking devices in high energy physics experiments has been a subject of intense development over the past few years. Typical applications call for the detection of minimum ionizing particles with position measurement accuracy of 10 μm in each detector plane. The most straightforward detector geometry is that in which one of the collecting electrodes is subdivided into closely spaced strips, giving a high degree of segmentation in one coordinate. Each strip may be read out as a separate detection element, or, alternatively, resistive and/or capacitive coupling between adjacent strips may be exploited to interpolate the position via charge division measrurements. With readout techniques that couple several strips, the numer of readout channels can, in principle, be reduced by large factors without sacrificing the intrinsic position accuracy. The testing of individual strip properties and charge division between strips has been carried out with minimum ionizing particles or beams for the most part except in one case which used alphs particless scans. This paper describes the use of a highly collimated MeV proton beam for studies of the position sensing properties of representative one dimensional strip detectors.

12944 **(CBPF-NF—035/81) Radon and radon-daughter exposure measurements by through-etched track registration in cellulose nitrate.** Knoefell, T.M.J.; Silva Estrada, J.J. da; Tavares, O.A.P.; Martins, J.B.; Goodwin, A. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1981. 37p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703357.

The use of cellulose nitrate films LR-115 type II (Kodak-Pathe) as a practical, exposure integrating device to measure the level of exposure to alpha particles in atmospheres which contain radon and radon-daughter products is investigated. The analysis of a number of cellulose nitrate films that have been exposed to calibrated radon test-chamber atmospheres has indicated good correlations between through-etched track density p and integrated alpha-particle exposure Σa (Working-Level-Hour). It is shown that the response of the cellulose nitrate detector to radon-daughter alpha-particle exposures is linear, and that reliable conservative estimations of the Working-Level-Hour can be obtained from $\Sigma a = 3.0(p-b)$, where p is expressed in tracks/mm^2 (b is the background level). These results recommend the use of the special red cellulose nitrate films as a convenient dosimeter for monitoring radioactive contaminants in mine atmospheres.

12945 **(CERN—82-06) Dynamical properties of charge-dividing proportional counters.** Schneider, F. (European Organization for Nuclear Research, Geneva (Switzerland)). 4 Jun 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703359.

Pulse shapes of currents in proportional counters are calculated for cases where the incident particle might pass at different distances from the wire. The pulse propagation along a resistive wire is treated with the help of Laplace transforms. The current as well as the collected charge on the ends of the counter are given. This work differs from the excellent treatment of the problem by Radeka by deriving compact analytic expressions for current rise and charge division of the appropriate pulse shapes, which can be handled even on a pocket calculator. Finally, the dynamic input resistances of amplifiers, which influence the precision of charge measurement, are evaluated.

12946 **(CONF-821011—41) Recent developments in thick mercuric iodide spectrometers.** Hull, K.; Beyerle, A.; Lopez, B.; Markakis, J.; Ortale, C.; Schnepple, W.; van den Berg, L. (EG and G, Inc., Goleta, CA (USA)). 1982. Contract AC08-76NV01183. 3p. NTIS, PC A02/MF A01. Order Number DE83003007.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

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Thick (~ 1 cm) mercuric iodide gamma-ray detectors have been produced which show spectroscopic qualities at moderate detector biases (~ 5 kV) comparable to those of thin spectrometers. Efficiency measurements indicate that the entire volume of the detectors is active. Spectra resolutions of less than 10% have been ob-

tained for gamma-ray energies above 1 MeV. Short charge collection times have produced the best results. Measurement of crystal charge transport properties is discussed. A small amount of bias conditioning is necessary for best performance. Operating parameters of the detectors have been investigated.

12947 **(DOE/ER/40039—6) Annual progress report for the high-energy-physics program at Texas A and M University, December 1, 1981-December 1, 1982.** McIntyre, P.M.; Webb, R.C. (Texas A and M Univ., College Station (USA). Dept. of Physics). 1982. Contract AS05-81ER40039. 45p. NTIS, PC A03/MF A01. Order Number DE83003707.

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The High-Energy Group at Texas A and M has continued to strengthen and grow during this the first full year of funding from the Department of Energy. The past year was marked by several successes: (a) the funding of our group's GUT monopole search, (b) the construction and testing of a prototype hadron calorimeter for the Fermilab Collider Detector, (c) a preliminary agreement on our group's responsibilities for the Fermilab Collider Detector, and (d) the beginning of the assembly of the monopole detector at Avery Island, Louisiana. The accompanying progress report will detail the progress being made by our group in these areas over the past year. In addition, future plans and funding requests for continued DOE support for the period April 1, 1983 to March 31, 1984, are presented.

12948 **(EGG-PHYS—5890) GAUSS VII: a computer program for the analysis of γ-ray spectra from Ge semiconductor spectrometers.** McCullagh, C.M.; Helmer, R.G. (EG and G Idaho, Inc., Idaho Falls (USA)). Oct 1982. Contract AC07-76ID01570. 122p. NTIS, PC A06/MF A01. Order Number DE83003721.

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A description is given of a computer program, GAUSS VII, which has been written to determine γ-ray spectra from Ge semiconductor spectrometers. The preliminary portions of the program can determine the energy and width calibration equations, loacte individual peaks and define peak regions that are significantly above the local spectral background. The user may edit these lists of peaks and regions. Each peak region is fitted with one or more components in which the peaks are represented by a Gaussian function or a Gaussian with one or two additive exponential tails on the low-energy side and one on the high-energy side. A step-like background function can be used with each component. The program will automatically recycle to add one or more components to a region if needed to improve the fit. The γ-ray energies and intensities are computed from resulting Gaussian positions and peak areas. To allow the user to determine the best results, the results from the analyses for each region with different numbers of components can be printed and line-printer plots of the fits to the data can be made. The quality of the results depends primarily on the ability of the program to define a good spectral region for each analysis and the ability to recycle to determine the proper number of components.

12949 **(EUR—7443) Basic statistics for nuclear electronics.** Stanchi, L. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 57p. (In Italian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703328.

The paper reports many equations of general utility in the non-destructive measurement of nuclear materials. Its content is the synthesis of several lectures given in various courses of nuclear electronics and non-destructive measurements. It does not contain original derivations but provides in a convenient format formulae which may be useful to experimenters in their daily work. General equations on variances and standard deviations as well as the probability of single observations are represented. The most common frequency distributions of events (binomial, normal, poissonian and interval) are presented and practical formulae are given. Particular attention is devoted to deadtime effects (even although the cascade of deadtimes is not considered) and to the regularizing effect of scalers. Finally a short examination of ratemeters and the resolution problem in detection and amplification chains is provided.

12950 (FS—79-19-AKD, pp 1-9) **Recent investigations of the thermoluminescence mechanisme in lithium fluoride.** Kos, H.J. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12951 (FS—79-19-AKD, pp 10-14) **New tasks and techniques in the measurement of high radiation doses.** Regulla, D.F. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12952 (FS—79-19-AKD, pp 17-36) **Results of an inquiry concerning experience gained in the use of thermoluminescent and phosphate glass dosemeters.** Burgkhardt, B.; Piesch, E.; Moos, W. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

The report summarizes the results of an inquiry among users of thermoluminescent and phosphate glass dosemeters, carried out within the framework of the working group for 'external radiation dose measurement' of the Fachverband fuer Strahlenschutz eV. The data presented came in from 24 laboratories, showing their experience in the use of 38 different dosemeters.

12953 (FS—79-19-AKD, pp 37-40) **State of the art in thermoluminescent dosimetry using dosemeters with automated read-out.** Regulla, D.F. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

In the beginning, the results obtained with automated read-out TLD have been quite disappointing, both for manufacturers and users. In response to this, industry then seeked advice and assistance from those experienced in the practical use of dosemeters, and the development of the second generation of automated TLD has been a common task of manufacturers and purchosers. As a preliminary achievement of development work along this line, a dosemeter has been presented by a Japanese manufacturer, meeting the requirements in quite a satisfactory way. The device is characterized by a frequency of disturbance of $< 5 \times 10^{-8}$, a microprocesor for controlling the measuring and control functions, possibility of active input of device parameters and boundary conditions, extensive self-control of operating functions, complete data protection, and thin-film detector technique. Pursuing this line of development, and taking into account future recommentations, automated thermoluminescent dosimetry does seem to be a promising alternative to current measuring techniques in personnel monitoring.

12954 (FS—79-19-AKD, pp 41-42) **Calibration of TLD-readers with standard light sources.** Burgkhardt, B.; Noellmann, C. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12955 (FS—79-19-AKD, pp 43-47) **Dosimetric properties of moderator-type neutron detectors.** Burgkhardt, B.; Piesch, E. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12956 (FS—79-19-AKD, pp 48-51) **Investigation of the energy dependence of the equivalent dose rate ludication protection purposes.** Alberts, W.G.; Cosack, M.; Dietze, G.; Jahr, R.; Kluge, H.; Knauf, K.; Lesiecki, H.; Matzke, M.; Ramthun, H.; Schuster, H.J. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12957 (FS—79-19-AKD, pp 52-57) **Energy dependence of neutron dosemeters for personnel monitoring.** Piesch, E.; Burgkhardt, B. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

The paper discusses the results of the Euratom comparative measurements carried out in Neuherberg and Braunschweig, which served as a basis for interpreting the energy dependence. The nuclear track detectors used for this purpose are fission fragment detectors, the NTA nuclear emulsion, and detectors such as LR-115 and makrofol for detecting neutron-induced recoil nuclei. Albedo dosemeters and the official phosphate glass dosemeters used in routine monitoring have also been investigated for their energy dependence.

12958 (FS—79-19-AKD, pp 58-61) **State of the art in Albedo-neutron dosimetry.** Piesch, E. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12959 (FS—79-19-AKD, pp 62-63) **Results of routine monitoring with albedo-dosemeters.** Piesch, E.; Burgkhardt, B. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12960 (FS—79-19-AKD, pp 74-75) **Use of a helium-3 filled proportional counter as a sensitive dose or dose equivalent meter.** Lucas, A.C. Mar 1979. Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12961 (FS—79-19-AKD, pp 76-77) **Measuring the neutron sensitivity of a Geiger-Mueller counter by time-of-flight spectroscopy.** Klein, H.; Guldbakke, S.; Jahr, R.; Lesiecki, H. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12962 (FS—79-19-AKD, pp 89-91) **Experience in the calibration of contamination monitors.** Heinzelmann, M. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

12963 **(FS—79-19-AKD) Current trends in personnel and environmental monitoring.** (Fachverband fuer Strahlenschutz e.V., Karlsruhe (Germany, F.R.)). Mar 1979. 127p. (In German). (CONF-7811205—). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83780191.

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

Abstracts of individual items from the meeting were prepared separately for the data base. (GHT)

12964 **(INIS-mf—7424) Development of a multiwire proportional chamber for nanodosimetry measurement of the energy deposition of alpha particles in smallest sensitive volumina.** Krueger, E.H. (Bremen Univ. (Germany, F.R.)). 21 May 1981. 126p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83780190.

Thesis.

Microdosimetrical measurements in gases hitherto could only simulate volumina down to 0.3 μm diameter (normalized to tissuers of the density 1 g/cm³). Using the multiwire chamber presented here are measuring instrument is developed which 1) excludes approximately wall effects, 2) is suitable for measurements in sensitive volumina with equivalent diameters in the order of magnitude of nanometers, 3) can be used fo acceleration experiments and on-line evaluation by process computers. Measurements of the energy deposed in methane were performed with α-particles with energies 8.77 MeV and 6.05 MeV and 4.05 MeV at pressures between 2.66 kPa and 0.133 kPa, corresponding to simulated diameters between 90 nm and 3.6 nm in the tissue. The measured distributions for the deposed energy differ remarkably from the distributions calculated according to the straggling theory of the energy losses of charged particles. The measurements showed that for volumina with 3.6 equivalent diameter more than 80% of the energy lost by the α-particle is deposed beyond the sensitive volumen. The core of the ionization tube around a petretrating, α-particle extends to a radius of about 3 nm. Around this core a region of low ionization density extends up to 100 nm.

12965 **(IPEN-Pub—31) Studies of alpha particle registration in LR-115 type II. A solid state nuclear track detector.** Cesar, M.F.; Geraldo, L.P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jun 1981. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703360.

The experimental condition for use of the cellulose nitrate film LR-115 type II as alpha particle detector is given. It was verified that the filme efficiency is a function of the alpha particle energy and etching conditions. The track counting was made in an optical screen microscope.

12966 **(IPEN-Pub—32) Dosimetric characteristics and radiation monitoring with $CaSO_4$(Dy):NaCl pellets.** Kathuria, S.P.; Campos, L.L.; Gordon, A.M.P.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jun 1981. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703361.

$CaSO_4$(Dy):NaCl Tl dosimeters, in the form of pellets, are used in the field for a period of one month. Before using these pellets for environmental and personnel radiation monitoring some of the important dosimetric characteristics like fading reusability and effect of ambient light are investigated and described. The pellets are used with plastic and lead filters for personnel and environmental radiation monitoring and the results obtained with the lead filters are in good agreement with those of the energy independent LiF dosimeters. A new combination of plastic, aluminium and lead filters is suggested for dose measurements in a mixed field of X, gamma and beta radiations.

12967 **(IPEN-Pub—40) Activity determination by a 4π-γ well-type ionization chamber.** Dias, M.S. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). Jan 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900844.

A 4π-γ ionization chamber system has been calibrated for radioactivity determinations of liquid samples. The efficiency curve was determined experimentally for the photons in the 60 keV to 2750 keV energy range. The experimental values were fitted to an analytical function of photon energy and a good agreement was observed over the entire range of energies.

12968 **(IPNO—81-04) Optical properties of the "Montpellier" spectrometer deduced from magnetic field measurement.** Lafoux, A. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1981. 15p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703363.

The optics characteristics of the spectrometer are given: momentum calibration, second order matrix, obtained by ray tracing in measured field maps.

12969 **(IPNO-RC—81-08) Parallel plate detectors.** Gardes, D.; Volkov, P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1981. 34p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703364.

A 5x3cm² (timing only) and a 15x5cm² (timing and position) parallel plate avalanche counters (PPAC) are considered. The theory of operation and timing resolution is given. The measurement set-up and the curves of experimental results illustrate the possibilities of the two counters.

12970 **(JINR—13-81-727) Elimination of ambiguity in determining track space orientation in multigap projection spark chambers.** Golovin, B.M.; Gornushkin, Yu.A.; Nadezhdin, V.S.; Petrov, N.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703365.

A method for eliminating the ambiguity in determining the straight track space orientation in the multigap projection spark chamber is described. The method is based on the use of dependence of track structure on a value of clearing field and its direction in chamber gaps. When clearing field is high enough and has opposite direction to high voltage pulse the track has anode and cathode dark spaces. As far as clearing field diminishes (having the same polarity) the cathode spaces narrow and anode spaces widen.

12971 **(LA-UR—82-3330) Bismuth germanate as a high-energy gamma-ray detector.** Wender, S.A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 5p. (CONF-821123—25). NTIS, PC A02/MF A01. Order Number DE83003535.

From 7. conference on the application of accelerators in research and industry; Denton, TX, USA (8 Nov 1982).

Portions of document are illegible.

The energy resolution, absolute efficiency, time resolution, and other performance parameters of bismuth germanate detectors for high-energy gamma detection are reported. (WHK)

12972 **(LAPP—81-04) Measurement methods for high energy particle identification in gaseous mixture detectors.** Marchand, Patrick. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules; Grenoble-1 Univ., 38 (France)). 1981. 88p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82703368.

Thesis.

In this work, we discuss some methods for high energy particle identification. We study and design a MWPC equipped with a preamplifier gap for increased resolution. In addition, we propose a new method of counting primary collisions. The electronic system used for multiplexing analog wire signals is also described.

12973 **(LBL—14456) Simple multifunction discriminator for multichannel triggers.** Maier, M.R. (Lawrence Berkeley Lab., CA (USA)). Oct 1982. Contract AC03-76SF00098. 5p. (CONF-821011—32). NTIS, PC A02/MF A01. Order Number DE83004193.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

Portions of document are illegible.

A simple version of a multifunction timing discriminator using only two integrated circuits is presented. It can be configured as a leading edge, a constant fraction, a zero cross or a dual threshold timing discriminator. Since so few parts are used, it is well suited for building multichannel timing discriminators. Two versions of this circuit are described: a quadruple multifunction discriminator and an octal constant fraction trigger. The different compromises made in these units are discussed. Results for walk and jitter obtained with these are presented and possible improvements are disussed.

12974 **(LBL—14916) High-purity germanium crystal growing.** Hansen, W.L.; Haller, E.E. (Lawrence Berkeley Lab., CA (USA)). Oct 1982. Contract AC03-76SF00098. 17p. (CONF-821107—39). NTIS, PC A02/MF A01. Order Number DE83004181.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

Portions of document are illegible.

The germanium crystals used for the fabrication of nuclear radiation detectors are required to have a purity and crystalline perfection which is unsurpassed by any other solid material. These crystals should not have a net electrically active impurity concentration greater than $10^{10}cm^{-3}$ and be essentially free of charge trapping defects. Such perfect crystals of germanium can be grown only because of the highly favorable chemical and physical properties of this element. However, ten years of laboratory scale and commercial experience has still not made the production of such crystals routine. The origin and control of many impurities and electrically active defect complexes is now fairly well understood but regular production is often interrupted for long periods due to the difficulty of achieving the required high purity or to charge trapping in detectors made from crystals seemingly grown under the required conditions. The compromises involved in the selection of zone refining and crystal grower parts and ambients is discussed and the difficulty in controlling the purity of key elements in the process is emphasized. The consequences of growing in a hydrogen ambient are discussed in detail and it is shown how complexes of neutral defects produce electrically active centers.

12975 **(NRPB-IE—21) Mini-instruments environmental monitor Type 5.10G. Instrument evaluation no. 21.** Burgess, P.H.; Iles, W.J. (National Radiological Protection Board, Harwell (UK)). Dec 1980. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703370.

The radiation, electrical, environmental and mechanical characteristics of the portable-battery operated exposure rate meter for measuring environmental and other low levels of radiation, the Mini Instruments Type 5.10 G, have been evaluated. It is shown that this instrument is a simple, accurate and easy to use environmental exposure-rate meter. It has a long battery life, a suitable dynamic range, an adequate energy response and a reasonable polar response.

12976 (PNL-SA—9950, pp 19-22) **Personnel neutron dosimeter utilizing radiochromic dyes.** Culp, R.A. (Bicron Corp., Newberry, OH). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

A liquid radiochromic dye dosimeter is presently being developed for x and gamma radiation, and is also being studied for its neutron sensitivity. These dyes, when combined with certain activators such as cyanide, have a long shelf life before irradiation and become deeply colored when exposed to ionizing radiation or ultraviolet light, and will not suffer a reverse reaction. The characteristics of dye-cyanide dosimeters are described. (KRM)

12977 (PNL-SA—9950, pp 23-26) **Gamma and fast neutron dosimetry with leuko dye optical waveguides.** Kronenberg, S. (ERADCOM, Fort Monmouth, NJ). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

To make radiochromic dyes applicable to radiation therapy, environmental emergencies, or personnel dosimetry, the sensitivity must be enhanced. this paper describes a method of enhancing the sensitivity of radiochromic dyes by increasing the optical path length well beyond the conventional 1 cm cuvette size. As a first step in this direction, optical guides have been constructed whose central core is a liquid solution of a leuko radiochromic dye. The sensitivity, energy dependence for photons, and neutron response are described. (KRM)

12978 (PNL-SA—9950, pp 27-35) **Personnel neutron dosimeters based on organic polymers.** Brackenbush, L.W. (Pacific Northwest Lab., Richland, WA); Quam, W.M. Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

This paper presents several ideas for personnel neutron dosimeters based upon organic semiconductors. These materials are of interest because of their high hydrogen content and compositions which more closely approximate tissue. The analogy of these proposed devices to existing silicon PIN diodes used for neutron dosimetry is discussed. Although diodes made from organic polymeric semiconductors seem to have great potential for use as neutron dosimeters, existing organic semiconductors are unstable in air and difficult to handle. There is a great deal of interest in semiconducting and metallic polymers, especially for solar cell applications, and many new semiconducting polymers are being synthesized. The authors are obtaining samples of some of these polymers for testing.

12979 (PNL-SA—9950, pp 39-42) **Personnel neutron dosimeters based on organic polymers.** Hurst, G.S. (Atom Sciences, Inc., Oak Ridge, TN). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

Resonance Ionization Spectroscopy, RIS, is a photophysics process in which pulsed lasers are used to remove electrons from those types of atoms which are selected by tuning the laser. Such processes can be saturated and hence with detectors that are sensitive to single electrons or ions, one-atom detection (OAD) can be achieved. In this paper, the possible application of OAD to neutron dosimetry is examined. (KRM)

12980 (PNL-SA—9950, pp 46-50) **Pocket neutron rem meter.** Quam, W.; Del Duca, T.; Plake, W.; Graves, G.; DeVore, T. (EGG/Santa Barbara Operations, Goleta, CA). Oct 1981. NTIS, PC A10/MF A01. Contract AC08-76NV01183.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

The design and sensitivity of a neutron dosimeter which combines a tissue-equivalent proportional counter with very-low-power, microprocessor-based electronics to give a compact self-contained rem-responding instrument are described. (KRM)

12981 (PNL-SA—9950, pp 51-63) **Hadron personnel monitoring around high-energy proton accelerators.** Hofert, M. (CERN, Geneva, Switzerland); Koczynski, A. Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

Due to the higher neutron energies encountered in the stray field around high-energy proton accelerators the use of the LR115 cellulose nitrate film as an element of the personnel dosimeter seems promising. In order to cover the lower energy end of the spectrum the LR115 is complemented by a TLD pair (^{6}LiF/^{7}LiF). A thorough investigation into the properties of the plastic detector (i.e., energy response, effect of different radiatiors, background, fading, development conditions, and determination of the optimum reading conditions) was followed by a pilot project in which practical experience in the field was accumulated. Wearing the film in parallel with the NTA film allowed a comparison between the two dosimeters.

12982 (PNL-SA—9950, pp 77-87) **Developments in solid state detectors for personnel neutron dosimetry.** Griffith, R.V.; Davidson, K.J.; Miller, D.E.; Vindelov, K.E. (Lawrence Livermore National Lab., CA). Oct 1981. NTIS, PC A10/MF A01. Contract W-7405-ENG-48.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

This paper describes two programs at Lawrence Livermore National Laboratory designed to examine additional dosimetry techniques to augment the Hankins type albedo personnel dosimeter now in use. The programs are the dosimeter/spectrometer (DOSPEC) in which track etch detectors are added to the albedo badge to provide some energy evaluation and gamma insensitivity, and development of solid state thin film MOS detectors to provide a real time, gamma insensitive dosimeter. (KRM)

12983 (PNL-SA—9950, pp 88-96) **Evaluation of a commercial, semi-automatic system for counting tracks in solid state nuclear detectors used for personnel dosimetry.** Espinosa, G. (Universidad Nacional Autonoma de Mexico); Griffith, R.V. Oct 1981. NTIS, PC A10/MF A01. Contract W-7405-ENG-48.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

The development of electrochemical etching (ECE) has significantly eased the effort needed to count tracks in plastic etch detectors. Detector areas 100 to 1000 times those possible with conventional etching can be counted in polycarbonate or CR-39 in an equivalent time when the ECE technique is used. However, when large numbers of detectors are to be counted, the effort can still be significant. Therefore, a comparatively low cost, automatic or semiautomatic system for counting could further reduce the processing time. This paper evaluates a relatively inexpensive commercial system that has been developed to count bacterial colonies grown in culture dishes. The pattern recognition problems in such counting are very similar to counting ECE tracks. (KRM)

12984 (PNL-SA—9950, pp 97-102) **Toward a sub-MeV personnel neutron dosimeter.** Ahlen, S.P.; Price, P.B. (California Univ., Berkeley). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

A method for the rapid counting of proton recoil tracks due to neutrons of less than 100 KeV is described. A composite consisting of a rugged glass substrate, an opaque metal film, and a track-etch polymeric film with a thickness comparable to the range of a 10 KeV proton is constructed. When covered with a polyethylene converter, the composite acts as a dosimeter. A successful demonstration of the idea using a commercially available composite consisting of a glass substrate, a 70 nm chromium film, and a sensitive positive resist film 400 nm thick is presented. The film was irradiated with Cf-252 fission fragments and alpha particles. (KRM)

12985 (PNL-SA—9950, pp 103-110) **Wide energy range Rem response personnel neutron dosimeter.** Eisen, Y.; Shamai, Y.; Ovadia, E.; Faermann, S.; Karpinovitch, Z.; Weingerten, R.; Schlesinger, T. (Soreq National Research Center, Yavne, Israel). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

A personnel neutron dosimeter is described which covers a wide energy range, and has several advantages: a Rem response in the energy range from 1 eV to 14 MeV; the lowest measurable dose is about 10 mRem in the energy range from 1 eV to 700 keV and about 15 mRem above this range; and the effective energy of the neutrons can be extracted from different responses of the various regions of the dosimeter. Results are summarized of the dosimetry behind shielding at several nuclear power reactors in the USA, and at the NBS in Washington using filtered monenergetic neutrons of 2, 24, and 144 keV and Cf-252 neutrons moderated by a 30 cm diameter sphere of D_2O. (KRM)

12986 (PNL-SA—9950, pp 111-120) **Application of a single sphere albedo technique in stray neutron fields.** Piesch, E.; Burgkhardt, B. (Karlsruhe Nuclear Research Center, Germany). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

The single sphere albedo technique which provides the precise measurement of the neutron dose equivalent, and an analysis of the neutron radiation field in terms of dose equivalent components with additional information on the corresponding direction of the radiation incidence, is described in this paper. By adapting the dosimeter system and the computer program with the well established experimentally found response functions, the routine application of albedo dosimeters is based only on a gamma ray calibration of the TLD system and field irradiations with the single sphere albedo dosimeter. (KLM)

12987 (PNL-SA—9950, pp 121-130) **Progress in albedo neutron dosimetry using TLD and track etch detectors.** Piesch, E.; Burgkhardt, B.; Hassib, G.M. (Karlsruhe Nuclear Research Center, Germany). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

This report summarizes work performed in developing a new albedo neutron dosimeter for a universal application of commercial TLD systems with full automatic read-out combined with track etch detectors. The boron loaded plastic encapsulation detects separately epithermal albedo neutrons and field thermal neutrons. The combination TLD and track etch detectors with neutron/alpha coverters allows the measurement of the neutron dose equivalent in high level gamma ray fields and provides information about at least three energy components. (KRM)

12988 (PNL-SA—9950, pp 131-138) **Experience and values in multi-dosimeter techniques.** Wheeler, R.V. (R.S. Landauer, Jr. and Co., Glenwood, IL). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

The NEUTRAK-ER (extended range) dosimeter which exhibits a response to neutrons from 0.4 eV to over 10 MeV is described. The dosimeter consists of a cadmium container utilizing a ILD-600/TLD-700 pair and a CR-39 dosimeter inside a cosmetically acceptable holder. The technique utilizes the advantages of the two separate dosimeter technologies into some single dosimetric alignment, and maximizes the value of these respective advantages. (KRM)

12989 (PNL-SA—9950, pp 139-144) **Feasible neutron dosimeter for stray neutron fields at PWRS.** Hajnal, F.; McLaughlin, J.E. (Dept. of Energy, New York, NY). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

Studies of the stray neutron fields inside the containments of PWRs have indicated that the presently available neutron dosimeters provide incorrect neutron dose values. The neutron dosimeters have varying and often strong energy dependent dose-equivalent responses. This paper describes a calculation method to correct for the albedo detector energy dependence. This correction works only for single neutron field exposures. The method is simple and does not require the explicit knowledge of the dose-equivalent responses of the dosimeter components. (KRM)

12990 (PNL-SA—9950, pp 145-152) **Neutron dosimetry development program at Rocky Flats.** Tyree, W.H.; Falk, R.B. (Rockwell International, Golden, CO). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

The Rocky Flats electronic neutron dosimeter with a surface barrier detector is described. The detector of this dosimeter is a surface barrier silicon detector coated with polystyrene to provide a homogenous medium to obtain a proton recoil, which is then detected by the detector. The dosimeter will provide real-time dose display, audio features, good sensitivity, and good energy response. (KRM)

12991 (PNL-SA—9950, pp 181-191) **Calibration of neutron dosimetry techniques for use in reactor buildings.** Brandon, W.E.; Cogburn, C.O.; Culp, R.R.; Sallee, W.W.; Williams, J.G. (Arkansas Univ., Fayetteville). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

Calibration techniques are described which have been used in the validation of activation foil measurements, as well as for the calibration of health physics instruments and dosimeters. Results of some of the measurements are presented and used to illustrate the method of wall-return correction. The calibrations were carried out in the refueling cell of the decommissioned SEFOR fast reactor, using bare and D_2O moderated californium sources. (KRM)

12992 (SLAC-PUB—2984) **Use of nitrogen laser for observation of space-charge effects in drift chambers.** Va'vra, J. (Stanford Linear Accelerator Center, CA (USA)). Oct 1982. Contract AC03-76SF00515. 4p. (CONF-821011—33). NTIS, PC A02/MF A01. Order Number DE83004416.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

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A two-stage nitrogen laser has been built and is presently being used to investigate properties of drift chambers. In this paper we present the measured parameters of this laser, the results of a study of the double track separation in a drift chamber of jet design and a measurement of the saturation effects in this chamber as a function of total gain. An understanding of the saturation effects is important for drift chambers with multiple hit capability. The laser technique reported here represents a major improvement in the simplicity of investigation of the double track separation and saturation effects.

12993 (SLAC-PUB—2987) **Versatile secondary trigger for a multi-detector system.** Ouimette, D.; Porat, D.; Tilghman, A.; Young, C. (Stanford Linear Accelerator Center, CA (USA)). Oct 1982. Contract AC03-76SF00515. 3p. (CONF-821011—34). NTIS, PC A02/MF A01. Order Number DE83004414.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

The electronics of a secondary trigger for particle physics is described. The system has several desirable features that solve track recognition problems in situations where several subsystems of various cell configurations participate in the decision making. Track curvature and multiplicity are the criteria used. Versatility is attained through the use of programmable Array Logic (PAL) and a 48-bit wide ROM-based sequencer that determines, with the resolution of a cell, the participation of each element in the decision process. Data from layers with arbitrary numbers of cells are shifted in a progammable manner through a PROM mask containing eight different track definitions. The results of any one of the eight triggering criteria are available 5.6 μs after the end of drift interval.

12994 (UCRL—86222) **Health physics instruments: what are the current needs.** Armantrout, G.A. (Lawrence Livermore National Lab., CA (USA)). 1982. Contract W-7405-ENG-48. 5p. (CONF-821011—40). NTIS, PC A02/MF A01. Order Number DE83004307.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

Portions of document are illegible.

Health Physics instruments are used to measure the risk which may be incurred by an individual exposed to a given radiation field. The response of the instrument sensors will differ markedly from actual human risk factors for a variety of reasons, and this requires the use of instrument modifications and conversion factors. The values of these conversion factors continue to be updated and will likely change in the future. To accommodate the effects of different types of radiation and new conversion and usage factors, new instruments should be able to determine the type, energy distribution, and direction of incoming radiation and then apply the proper weighting factors to determine relative human risk. Such instrumentation will need to utilize modern sensor elements and microprocessor electronics.

12995 **Lead-glass gamma-ray detector for relativistic heavy-ion collisions.** Budiansky, M.P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Ahlen, S.P.; Tarle, G. (California Univ., Berkeley (USA). Space Sciences Lab.). *Nuclear Instruments and Methods in Physics Research;* **199**: No. 3, 453-460(15 Aug 1982).

WE have developed a detector for high energy (approx. equal to 20-400 MeV) gamma-rays resulting from relativistic heavy-ion collisions. The system consists of an array of lead-glass blocks, along with an arrangement of plastic scintillators and a plastic Cherenkov detector. By using RCAs 'teacup dynode' phototubes, we have achieved an energy resolution significantly superior to any previously reported: the fwhm of the measured energy distribution for electrons entering the array is approx. equal to $5.7\%/\sqrt{E}$ (GeV). The problem of neutron background required especially careful consideration in the design, and we describe measurement techniques for insuring a clean photon signal. We have calibrated the system at the LLNL electron linac, and we mention a simple and convenient method of obtaining a tagged photon beam.

12996 **Efficiency calibration of a Ge detector for 30-2800 keV γ rays.** Helmer, R.G. (Idaho National Engineering Lab., Idaho Falls (USA)). *Nuclear Instruments and Methods in Physics Research;* **199**: No. 3, 521-529(15 Aug 1982).

As an illustration of the precision currently possible in γ-ray spectrometry, the calibration of a Ge detector for the measurement of emission rates of γ rays between 30 and 2800 keV is described. The estimated uncertainty in the resulting efficiency for point sources varies from 2% below 85 keV to 0.5% from 400 to 1400 keV. This calibration involved about 19 sources, 18 nuclides and 58

γ rays with energies from 14 to 2754 keV. These sources, obtained primarily from two metrology laboratories and our own laboratory, included both primary standards and secondary standards. Some deviations between the efficiency values from different nuclides and sources of the same nuclide are noted. The magnitudes of the necessary corrections and the various components of the uncertainty are discussed. An observed variation of the efficiency with time is illustrated and discussed.

12997 **Characterization of large diameter silicon by low-bias charge collection analysis in Si(Li) pin diodes.** Fong, A.; Walton, J.T.; Sommer, H.A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.); Haller, E.E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.; California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering); Guldberg, J. (TOPSIL, Frederikssund (Denmark)). *Nuclear Instruments and Methods in Physics Research;* **199**: No. 3, 623-630(15 Aug 1982).

Five silicon single crystals, approx. equal to 5 dm in diameter, grown under different conditions were examined for their suitability as Si(Li) detector grade material. A correlation was found between a crystal growth process parameter and incomplete and nonhomogeneous charge collection in the finished Si(Li) detectors when biased at voltages much lower than normally applied in detector operation. Data are presented and a model based on the presence of interstitial defects is proposed to explain the observed results.

12998 **Energy dependence of the response of a ^{3}He long counter.** Evans, A.E. Jr. (Los Alamos National Lab., NM (USA)). *Nuclear Instruments and Methods in Physics Research;* **199**: No. 3, 643-644(15 Aug 1982).

Letter-to-the-editor.

A polyethylene-moderated ^{3}He neutron detector that had previously been found to have an energy-independent efficiency for broad-spectrum neutron sources is apparently resonant to 450 keV neutrons.

12999 **Measurements of radial and longitudinal hadron shower development at 300 GeV.** Gollon, P.J.; Awschalom, M.; Baker, S.I.; Coulson, L.; Moore, C.; Velen, S. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Instruments and Methods in Physics Research;* **189**: No. 2/3, 387-394(1 Nov 1981).

We present the first measurements of the average energy deposition (as measured by small scintillators) in hadron showers produced by 300 GeV protons as a function of position in Al, Fe and Pb multiplate calorimeters. Sample energy deposition spectra are also presented for the first time. These measurements may be used as 'benchmark' comparisons for Monte Carlo hadron cascade programs.

13000 **Calculations of the interference of annihilation radiations with positron spectra in a Ge detector.** Avignone, F.T. III; Noma, H. (South Carolina Univ., Columbia (USA)); Moltz, D.M.; Toth, K.S. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **189**: No. 2/3, 453-458(1 Nov 1981).

The distortion of the Kurie plots of allowed positron spectra due to annihilation radiations was calculated by a simple Monte-Carlo technique for a small intrinsic Ge detector. The experimentally observed non-linearity near the end point is accurately reproduced by the calculations. Corrections were calculated for 15 theoretical allowed spectra with end-point energies ranging from 2.5 to 10 MeV for one small detector 1.6 cm in diameter and 0.7 cm thick and one larger detector 4.0 cm in diameter and 1.0 cm thick. The major effect of this interference is to shift the end-point up in energy from 182 keV at 2.5 MeV and to 204 keV at 9 MeV in the small detector and from 279 keV at 2.5 MeV and to 321 keV at 9 MeV in the larger detector. The method was used to correct the end-point energies of the two positron branches in the decay of ^{82}Sr. The corrected data give values of (3.19 +- 0.02) and (2.42 +- 0.02) MeV. The resulting Q-value is (4.21 +- 0.02) MeV.

13001 **Cryogenic ionization chamber for high-resolution fission cross-section measurements.** Extermann, R.C.; Auchampaugh, G.F.; Moses, J.D.; Olsen, C.E. (Los Alamos National Lab., NM (USA)); Hill, N.W. (Oak Ridge National Lab., TN (USA)). *Nuclear Instruments and Methods in Physics Research;* **189**: No. 2/3, 477-484(1 Nov 1981).

This paper describes a multiple-plate gas ionization chamber designed for cross-section measurements of neutron-induced fission in strongly radioactive nuclei. The requirements of high resolution are discussed, in particular the need for cooling the sample to reduce Doppler broadening and the selection of the gas mixtures that will enable fast counting at a low temperature. The observed gain in resolution with cooled samples is in good agreement with theoretical predictions.

13002 **SLAC Mark II Detector (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2777). Contract AC03-76SF00515.

3 aperture cards.

Drawings are included for the installation of the magnetic detector, the coil compensating solenoid and the mobile detector platform. (GHT)

13003 **SLAC Camac Crate Controller Model 3 (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2775). Contract AC03-76SF00515.

20 aperture cards.

Information is provided for the construction of a CAMAC crate controller used at SLAC. The controller directs data from the CAMAC branch highway input to the various crate modules used in that particular crate. (GHT)

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

REFER ALSO TO CITATION(S) 12914

13004 **Computer modeling and radiation testing of AlGaAs photodiode structures.** Osbourn, G.C.; Dawson, L.R.; Wiczer, J.J. (Sandia National Lab., Albuquerque, NM). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science;* **NS-28**: No. 6, 4342-4345(Dec 1981). Contract AC04-76DP00789.

A detailed one-dimensional computer model has been used to identify the device characteristics which determine the undesirable current induced in various AlGaAs photodiode structures by ionizing radiation. The calculations were performed to aid in the design of AlGaAs photodiode structures operating at λ=.82μm with optimized radiation insensitivities. Various AlGaAs photodiode structures have been grown and experimentally characterized to test the model. Good agreement between calculated and measured characteristics have been obtained, indicating that the model provides a good description of the factors affecting the radiation sensitivity and the optical response of AlGaAs photodiodes.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 12131, 12888, 13021, 13117

13005 **(BDX—613-2854) Evaluation of coordinate measuring machines.** Russell, R.J. (Bendix Corp., Kansas City, MO (USA)). Nov 1982. Contract AC04-76DP00613. 26p. NTIS, PC A03/MF A01. Order Number DE83004098.

Positional accuracy, thermal distortion, and load distortion of the coordinate measuring machine (CMM) are among the most-important factors contributing to the final accuracy of the inspected tool or gage. This report addresses the positional accuracy of the CMM and describes a method to evaluate the volumetric accuracy of a bridge design CMM work zone (the volumetric space that houses inspection points on a part to be inspected).

13006 **(DOE/EV/03221—73) Fast A/D conversion and processing system based on video digitizing of oscilloscope traces. Progress report, July 1981-June 1982.** Avitzour, A.R. (Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry). 1982. Contract AC02-76EV03221. 47p. NTIS (US Sales Only). Order Number DE83004779.

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The need for a reasonably priced, fast digitizing instrument, suitable for capture and processing of fast single shot transients, led to the development and construction of the RADIAN SYSTEM (completed recently). Following former systems, such as SANDIA's, the system is based on a TV camera attached optically to an oscilloscope screen, and on logic circuits for digitizing by processing of the video signal. The oscilloscope in our system is TEKTRONIX 7844 DUAL BEAM. Both digitizing and display of the system are dual channel. Efforts have been made to make the system self-contained and of relatively low cost. The system has its own, though limited, built-in interactive graphic and alphanumeric terminal, and for both characters and transient data it is interfaced as a teletype. Therefore, there is no need to build a special interface while connecting the system to a computer. Furthermore, it can be easily connected to different computers.

13007 **(ORNL/TM—8589) Investigation of the effect of the uranyl ion on proton-spin-relaxation times in aqueous solutions.** Renshaw, A.W. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 56p. NTIS, PC A04/MF A01. Order Number DE83005169.

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The purpose of this project was to determine the effect of the uranyl ion on the spin-lattice relaxation time of protons in aqueous solutions. A flowmeter using nuclear magnetic resonance (NMR) techniques is being designed for monitoring the flow rate of aqueous solutions which are acidic, contain plutonium and uranium ions, chemical waste, and radioactive waste materials. The spin-lattice relaxation time is critical to the design of a flowmeter using nuclear magnetic resonance techniques. Experimental studies showed that spin-lattice relaxation time did not change for different molar concentrations of sample solutions of uranyl nitrate and uranyl acetate prepared from pure laboratory chemicals dissolved in distilled water. Therefore, it was concluded that the uranyl ion does not contribute to the relaxation process for protons in water.

13008 **(UCRL—87728) DDCMP protocol on a DMA serial-line board.** Hunt, D.N.; Kessler, G.C. (Lawrence Livermore National Lab., CA (USA)). 1982. Contract W-7405-ENG-48. 6p. (CONF-821201—10). NTIS, PC A02/MF A01. Order Number DE83004208.

From Fall DECUS US Symposium; Anaheim, CA, USA (6 Dec 1982).

Portions of document are illegible.

The Nuclear Chemistry Division of Lawrence Livermore National Laboratory is in the midst of an upgrade to their radiation counting facility. The result of this upgrade wil be a computer-based data acquisition network, the Nuclear Chemistry Counting Facility Network (NCCF-NET). This network will consist of forty dedicated LSI-11/2 based controllers, ten interactive LSI-11/23 based workstations and a VAX-11/750 central node for data reduction and storage. One of the data acquisition instruments used in this network is a Nuclear Data pulse-height analyzer, the ND66L. This analyzer communicates to a host system over a 9600-baud serial line, using the DDCMP link level protocol. In order to relieve the host computer from the overhead of handling the DDCMP protocol, an in-house designed DMA serial line board was implemented to communicate with the ND66L. The hardware used and its environment will be duscussed along with the design and implementation of the firmware, which implements the serial DDCMP link.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

13009 **(MHSMP—82-41) Effect of thermal aging on the thermal stability and friction sensitivity of explosives.** Foster, P.A.; Demerson, E.L. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Dec 1982. Contract AC04-76DP00487. 30p. NTIS, PC A03/MF A01. Order Number DE83005031.

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Five explosives (LX-10, PBX 9501, PBX 9502, HMX/Kraton, and RX-03-DI), were aged in helium and air atmospheres at temperatures of ambient, 40, 50 and 70 C for 18 months. Thermal analysis (CRT, Henkin, DSC) showed little change in the explosives. Friction tests indicate the PBX 9501 to be less sensitive after 70 C aging which is probably due to binder degradation. Atmospheric analysis of the contaiers with PBX 9501 shows the explosive undergoes degradation (probably binder) at the 70 C temperature. It appears that LX-10 may become more friction sensitive after aging. No conclusions could be reached regarding the effect of thermal aging on the friction sensitivities of the other explosives.

13010 **(MHSMP—82-47) Reproducibility of the Langlie Technique for establishing probabilities of LX-10 skid initiation.** Ashcraft, R.W.; Crutchmer, J.A. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Dec 1982. Contract AC04-76DP00487. 8p. NTIS, PC A02/MF A01. Order Number DE83004947.

Two skid test series on LX-10 have been performed utilizing the Langlie Technique to determine testing levels. The log-normal distributions produced by the ASENT analysis of these data were then used as standards for a simulation study. Five skid series were derived for each of the two distributions to determine the reproducibility of the Langlie Technique. The ten sets of parameter estimates were found to be reasonable approximations to the true parameters and reproducibility was found to be a function of probability.

13011 **(SAND—82-2529C) Arming and firing system for PRE-DIRECT COURSE.** Skenandore, L.H. (Sandia National Labs., Albuquerque, NM (USA)). 1 Nov 1982. Contract AC04-76DP00789. 7p. NTIS, PC A02/MF A01. Order Number DE83003916.

PRE-DIRECT COURSE was a Defnse Nuclear Agency (DNA) sponsored high explosive test designed to determine whether a large scale height-of-burst (HOB) tst is operationally achievable. It consisted of 23 tons of ammonium nitrate and fuel oil (ANFO) at a HOB of 57 feet. Target response experiments were not included in this test. The ANFO was loaded into a honeycombed fiberglass sphere nine and one-half feet in diameter mounted atop a steel tower. A sphere of octol with a nominal weight of 64 pounds was used as the main booster. Two flexible confined detonating cord (FCDC) assemblies, originally developed as part of the TRIDENT missile program, were used to transfer detonation from two exploding bridgewire (EBW) detonators to the octol sphere. The design, installaton,and field testing of the firing system are described. On event day, final arming procedures went smoothly and all detonator connection verification measurements read as expected. During the countdown all monitors responded normally. At zero-time, the fiducial signals were recorded with the proper timing and amplitude.

13012 **(UCID—19640) PBX-9407 mechanical properties.** Schauer, D.A. (Lawrence Livermore National Lab., CA (USA)). Dec 1982. Contract W-7405-ENG-48. 25p. NTIS, PC A02/MF A01. Order Number DE83005034.

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PBX-9407 is weaker in tension than other HE's, stiffer in compression than other HE's, and does not strain nearly as much under load at temperatures above 20°C as other HE's. PBX-9407 data has been used to define constants for computer code models. 20 figures.

4502 Nuclear

13013 **(NVO—214) Enewetak fact book (a resume of precleanup information).** Bliss, W. (comp.). (Department of Energy, Las Vegas, NV (USA). Nevada Operations Office). Sep 1982. 219p. NTIS, PC A10/MF A01. Order Number DE83004468.

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The book contains a group of short treatises on the precleanup condition of the islands in Enewetak Atoll. Their purpose was to provide brief guidance to the radiological history and radiological condition of the islands for use in cleanup of the atoll. (ACR)

13014 **(SAND—81-1871) Tonopah Test Range capabilities: technical manual.** Manhart, R.L. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 67p. NTIS, PC A04/MF A01. Order Number DE83005362.

Portions of document are illegible. Printed copy available until stock is exhausted.

This manual describes Tonopah Test Range (TTR), defines its testing capabilities, and outlines the steps necessary to schedule tests on the Range. Operated by Sandia National Laboratories, TTR is a major test facility for DOE-funded weapon programs. The Range presents an integrated system for ballistic test vehicle tracking and data acquisition. Multiple radars, optical trackers, telemetry stations, a central computer complex, and combined landline/RF communications systems assure full Range coverage for any type of test. Range operations are conducted by a department within Sandia's Field Engineering Directorate. While the overall Range functions as a complete system, it is operationally divided into the Test Measurements, Instrumentation Development, and Range Operations divisions. The primary function of TTR is to support DOE weapons test activities. Management, however, encourages other Government agencies and their contractors to schedule tests on the Range which can make effective use of its capabilities. Information concerning Range use by organizations outside of DOE is presented. Range instrumentation and support facilities are described in detail. This equipment represents the current state-of-the-art and reflects a continuing commitment by TTR management to field the most effective tracking and data acquisition system available.

13015 **(UCID—19643) Timing and control monitor system requirements: an overview.** Brandt, J.J. (Lawrence Livermore National Lab., CA (USA)). 20 Dec 1982. Contract W-7405-ENG-48. 25p. NTIS, PC A02/MF A01. Order Number DE83005033.

An overview of the Requirements Document for the Timing and Control Monitor System Upgrade Project is presented. This project is intended to provide a replacement system for the existing User Encoder Monitor Systems and Varian 72 Control Room computer systems. All of these systems reside at the Nevada Test Site. The function of the T and C Monitor System is to gather statistics and data on user defined key variables from control, communication, and data acquisition systems, and from the monitoring system itself. The control, communication, and data acquisition systems each operate separately from the monitor system. The T and C Monitor System gathers this data in on order to: verify the readiness of an event to begin countdown; report any failures that may occur during the countdown; verify detonation and containment; and assist reentry activities after the event.

13016 **(UCRL—88474) Automated core-test experiment.** Crawford, P.C.; Bedford, R.G.; Barton, V.C. (Lawrence Livermore National Lab., CA (USA)). Dec 1982. Contract W-7405-ENG-48. 17p. (CONF-821038—8). NTIS, PC A02/MF A01. Order Number DE83004288.

From 10. annual DOE compatibility conference; Albuquerque, NM, USA (26 Oct 1982).

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A system has been designed and built to thermally cycle one or two core-test units automatically. Evolved gas pressures, temperatures, and electrical characteristics of components are measured at specified times. These values and a log of significant events are stored in data files on the computer disk. Gas samples are taken automatically when the pressure reaches a predetermined level. Data can be reviewed and the status of the experiment checked at a remote terminal as well as at the console. Data-acquisition and gas-sampling parameters can be changed while the experiment is in progress. The system incorporates extensive hardware and software safety features. A description of the system, the operating software, and some results are presented. 6 figures.

4503 Explosion Detection

REFER ALSO TO CITATION(S) 11663

13017 (UCRL—52000-82-11, pp 14-23) **Regional seismic test network.** Nov 1982. NTIS, PC A03/MF A01.

In Energy and technology review.

Studies of the performance of a prototype seismic-detection network designed to monitor compliance with the proposed Threshold and Comprehensive Test Ban Treaties are described. (GHT)

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

13018 **(BNL—32178) Long-range interaction of small soot particles.** Marlow, W.H. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 5p. (CONF-821224—1). NTIS, PC A02/MF A01. Order Number DE83003958.

From Combustion Institute fall technical meeting on chemical and physical processes in combustion; Atlantic City, NJ, USA (14 Dec 1982).

The origins of van der Waals or intermolecular forces between condensed media are discussed. Methods for the calculation of energies and collision rate enhancements are reviewed briefly. It is pointed out that the subject of long-range interactions of small soot particles is in its beginning stage.

13019 **(BNL—51606) MONEX79 atmospheric boundary-layer experiment over the Bay of Bengal: Digha data report.** SethuRaman, S.; Henderson, C. (Brookhaven National Lab., Upton, NY (USA)). Aug 1982. Contract AC02-76CH00016. 63p. NTIS, PC A04/MF A01. Order Number DE83005456.

An atmospheric boundary layer experiment was conducted over the Bay of Bengal during MONEX79 at the coast of Digha, West Bengal, India located at 21°30'N, 88°E. The boundary layer experiment consisted of continuous measurements of meteorological variables, turbulence and surface fluxes, and profiles of wind speed and direction in the marine boundary layer. The observation system used in the experiment is briefly discussed, and a summary of the data collected reported.

13020 **(CONF-821136—6) Cloud water: an important vector of atmospheric deposition.** Lovett, G.M.; Reiners, W.A. (Oak Ridge National Lab., TN (USA); Dartmouth Coll., Hanover, NH (USA). Dept. of Biological Sciences). 1982. Contract W-7405-ENG-26. 9p. NTIS, PC A02/MF A01. Order Number DE83004646.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Because advective fogs are wind-borne, they not only wet vegetation, but can deliver large amounts of water and dissolved ions to the earth's surface. Previous efforts to measure cloud and fog water deposition are reviewed, and current studies are summarized. To evaluate the importance of impaction, sedimentation, and evaporation to the process of cloud water deposition, these physical processes were modeled for the subalpine balsam fir (Abies balsamea) forests of the northern Appalachians. The model was tested in several ways. Results indicate that for a canopy of given structure, the primary factors influencing the gross cloud droplet deposition

are wind speed, cloud liquid water content, and cloud droplet size distribution. Rates of ionic deposition during cloud events are reported.

13021 **(DFVLR-MITT—81-28) Planning of a C-band-pulse-Doppler-radar with polarization diversity for atmospheric research in the meso-scale range.** Schuster, H. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). 1981. 48p. (In German). Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Koeln, Germany.

Research in the field of cloud physics demands as part of the problem, the availability of measured values of relevant meteorological parameters connected with a complete information of the behaviour of the observed object in space and time. This problem can essentially be solved using remote-sensing methods, especially radar measuring methods. The analysis of the requirements following by meteorolocal problems and by measuring methods results in the definition of a suitable radar-system of following type: computer-controlled Pulse-Doppler-Radar with polarization diversity and digitized radar-signal processing. To optain optimum adaption to the meteorological problems inquestion, a semi-mobile design of the device is projected. The fundamental attributes of the radar-system are summarized in a special section.

13022 **(LA—9601-MS) Diurnal variability of wind velocity increase with height.** Abeele, W.V. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 9p. NTIS, PC A02/MF A01. Order Number DE83005604.

All indications are that wind velocity increase with height is a strong function of temperature stratification. The stronger the inversion, the greater the increase in wind velocity with height, whereas the more superadiabatic the lapse rate, the less the increase. Because superadiabatic lapse rates are most likely to be found about noon, it is expected that the wind speed increase will reach a minimum about that time. Inversions are predominantly night and morning phenomena; thus, a maximum increase in wind speed with height will be obtained at those times.

13023 **(PNL—4406) Simple nocturnal slope-flow data from the Rattlesnake Mountain site.** Horst, T.W.; Doran, J.C. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1982. Contract AC06-76RL01830. 103p. (ASCOT—82-5). NTIS, PC A06/MF A01. Order Number DE83004100.

Detailed vertical profiles of the wind and temperture structure of nocturnal slope flows were measured at a site that is uniform in the cross-slope direction. The upper part of the slope closely approximates a simple, tilted plane. These measurements were made from three towers at different distances from the ridge crest, each of which extended through the local depth of the katabatic flow. The tower wind and temperature data from the four best cases of slope flow observed in 1980 and 1981 are listed, as well as ambient wind and temperature profiles to a height of 300m from a Tethersonde flown at the experimental site and surface winds from a network of stations surrounding the site.

13024 **(PNL-SA—10917) Interpretations of the OSCAR data for reactive-gas scavenging.** Easter, R.C.; Hales, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 14p. (CONF-821136—5). NTIS, PC A02/MF A01. Order Number DE83003597.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

A description is given of the application of a reactive scavenging model for the interpretation of data from the Oxidation and Scavenging Characteristics of April Rains (OSCAR) field study to evaluate scavenging mechanisms. The OSCAR experiment, conducted during April 1982, was a cooperative field investigation of wet removal by cyclonic storms. A part of the experiment involved intensive measurements at a site in NE Indiana and was designed to provide needed inputs for diagnostic scavenging models. Sequential precipitation chemistry, surface and airborne air chemistry, cloud physics, and meteorological measurements were performed. The model application reported here involves a single storm event at the Indiana site. Although the work presented involves the analysis of only a single precipitation event over a limited geographical area (10^4 km^2), the data utilized have considerable uncertainties, and the model contains numerous approximations, it is nevertheless concluded that the ability of the model to reproduce much of the observed precipitation chemistry behavior for the event is quite encouraging.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 11872, 11961, 13045, 13046, 13061, 13062, 13101, 13186

13025 **(DOE/EV/10019—6) Effects of increased CO_2 on photosynthesis and agricultural productivity. Volume II, Part 6. Environmental and societal consequences of a possible CO_2-induced climate change.** Baker, D.N.; Allen, L.H. Jr.; Lambert, J.R. (Mississippi State Univ., Mississippi State (USA); Florida Univ., Gainesville (USA); Clemson Univ., SC (USA)). Oct 1982. Contract AS01-79EV10019. 109p. NTIS (US Sales Only). Order Number DE83003029.

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This report addresses the direct effects of increased CO_2 concentration on plant processes, and the indirect effects of climate changes caused by increased CO_2 concentrations. It limits indirect climatic change or effects on plants to temperature and rainfall. Growth of a crop involves several physiological processes, e.g., photosynthesis, respiration and transpiration. The integral of these and other processes over a season results in yield - grain, tubers, etc. Both positive and negative responses of these processes to climatic changes occur. Some of these individual responses are known; many others are not. Because of the complex nature of the interdependence and feedback of the total physiological system, quantitative prediction of the net response to a climatic change, especially in genotypes yet to be developed, is impossible. Therefore a systems simulation analysis is necessary. Research needs, to evaluate the effects of increased CO_2 on agricultural productivity, include the need for controlled environment experiments to measure crop responses to climate, done in such a way that the resulting data are useful in system studies.

13026 **(DOE/EV/10450—T4) Wood combustion: state-of-knowledge survey of environmental, health and safety aspects.** (Mueller Associates, Inc., Baltimore, MD (USA)). Oct 1981. Contract AC01-81EV10450. 128p. NTIS, PC A07/MF A01. Order Number DE83005070.

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This state-of-knowledge document is one of several reports prepared to summarize the types and depth of research completed in the last several years related to the environmental, health, and safety aspects of solar and biomass energy technologies. This report is a synthesis of environmental data and information relevant to wood combustion, particularly residential wood combustion. It emphasizes results obtained during 1980 and the first half of 1981. Where appropriate, it provides details of work reviewed, while in other cases it refers the reader to appropriate sources of information.

13027 **(DOE/EV/10502—2) Prevention and control of LNG tanker spills with membrane barrier systems inside cargo tanks. Final technical report, October 1981-November 1982.** Athens, P.; Hagopian, J.H.; Lindstrom, R.S. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Dec 1982. Contract AC01-81EV10502. 80p. NTIS, PC A05/MF A01. Order Number DE83005243.

An investigation to determine the feasibilit of bladder or curtain-type membranes installed within liquefied natural gas (LNG) cargo tanks as spill barrier systems is reported. The purpose of the barrier system(s) is to prevent or control spillage of LNG following a breaching of the cargo containment structure of an LNG vessel. The work program included a study of the mechanical and structural feasibility of such systems; the selection of candidate materials and composites and the determination of their mechanical behavior properties at cryogenic temperatures; and an assessment of the effectiveness and costs of such barrier systems. Small-scale model test

were conducted to demonstrate the behavior of suspended curtain-type barrier systems to simulated breaching of the cargo tank wall. As a result of this work, the effectiveness of curtain-type spill barrier systems has been proven in principle. Such systems, furthermore, should be applicable and feasible for all types of bulk liquid cargoes whether in mobile or stationary tanks. Further evaluation with larger-scale modelling of cargo tanks, and more detailed study of appropriate barrier materials and barrier deployment and control methods are recommended.

13028 **(LA-UR—82-3489) Quality assurance for environmental analytical chemistry at Los Alamos.** Gladney, E.S.; Perrin, D.R.; Goode, W.E. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 13p. (CONF-821215—4). NTIS, PC A02/MF A01. Order Number DE83004729.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

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The basic structure philosophy of the program as it has evolved over the past five years is discussed with particular emphasis on traceability and use of certified reference materials. Typical summary results of the program and interactive computerized quality assurance system are presented.

13029 **(NP—3901079) Acid rain: a background report.** Glustrom, L.; Stolzenberg, J. (Wisconsin Legislative Council Staff, Madison (USA)). 8 Jul 1982. 72p. NTIS, PC A04/MF A01. Order Number DE83901079.

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This Staff Brief was prepared for the Wisconsin Legislative Council's Special Committee on Acid Rain to provide an introduction to the issue of acid rain. It is divided into four parts. Part I provides an overview on the controversies surrounding the measurement, formation and effects of acid rain. As described in Part I, the term acid rain is used to describe the deposition of acidic components through both wet deposition (e.g., rain or snow) and dry deposition (e.g., direct contact between atmospheric constituents and the land, water or vegetation of the earth). Part II presents background information on state agency activities relating to acid rain in Wisconsin, describes what is known about the occurrence of, susceptibility to and effects of acid rain in Wisconsin, and provides information related to man-made sources of sulfur and nitrogen oxides in Wisconsin. Part III describes major policies and regulations relating to acid rain which have been or are being developed jointly by the United States and Canadian governments, by the United States government and by the State of Wisconsin. Part IV briefly discusses possible areas for Committee action.

13030 **(PNL-SA—8281) Effect of using time-averaged precipitation for wet removal in a Lagrangian assessment model.** Davis, W.E.; Eadie, W.J. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1980. Contract AC06-76RL01830. 17p. (CONF-800802—29). NTIS, PC A02/MF A01. Order Number DE83002737.

From 89. annual meeting of the American Institute of Chemical Engineers; Portland, OR, USA (17 Aug 1980).

Further results are presented of the test of a regional scale assessment model using two modes of precipitation, hourly and average turned on and off with the natural frequency. The test cases were carried out for a release of SO_2 with transformation to SO_4 at two different sites in the United States for four months (January, April, July, and October, 1974). The results demonstrated that the use of average precipitation turned on and off with the natural frequency could be used instead of hourly precipitation for long-term assessments.

13031 **(PNL-SA—10558) Accident-generated aerosols: assessment methodology.** Sutter, S.L.; Owczarski, P.C.; Ballinger, M.Y.; Bander, T.J.; Chan, M.K. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1982. Contract AC06-76RL01830. 5p. (CONF-821103—58). NTIS, PC A02/MF A01. Order Number DE83003461.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Research underway to develop methods of assessing accidental airborne releases is reviewed. The objective of this study is to develop techniques to make reasonable estimates of the quantity and characteristics of accident-generated aerosols from fires, explosions, tornadoes, and other accidents with potentially serious consequences. Several accident scenarios, which are comprised of a series of several release events are being examined. The mechanisms of these events are being identified. The goal of this work is to estimate the magnitude of energy developed in the accident and mass of particles released. The study has several thrusts which include reviewing literature, performing experiments to develop new data as required, developing models, and finally compiling an accident analysis handbook.

13032 **(TENRAC/EDF—057-Vol.1) Plan to evaluate acid-deposition issues in the state of Texas. Final report.** Levy, J.A. Jr. (Espey, Huston and Associates, Inc., Austin, TX (USA)). 15 Jan 1982. 90p. NTIS, PC A05/MF A01. Order Number DE83900818.

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The development of a coherent, organized plan to investigate acid deposition in Texas is proposed. A preliminary evaluation of the acid deposition problem nationwide and its relevance to the State of Texas has been completed. Monitoring continues in the eastern portion of the state where potential exists for future problems. There is a variety of natural and anthropogenic sources of airborne material important to the process of acid deposition in Texas. In general, these sources are different in character than those found in other, more thoroughly investigated, areas of the country. Two of the primary acid deposition precursors are emissions of nitrogen oxides (NO/sub x/) and sulfur dioxide (SO_2). No single source category has been found to be a predominant SO_2 or NO/sub x/ producer. Impacts on Texas from anthropogenic sources in adjacent states and Mexico are possible but are undetermined at this time. Natural sources of airborne material can, possibly, be important in determining local and regional impacts. These natural sources include sea salts from the constal areas of the state, biogenic sulfur emissions from soils and vegetation, and alkaline particles raised by wind erosion of west Texas soils. (PSB)

13033 **(TENRAC/EDF—057-Vol.2) Acid deposition in Texas: technical summary and perspective. Final report.** Levy, J.A. Jr. (Espey, Huston and Associates, Inc., Austin, TX (USA)). 15 Jan 1982. 172p. NTIS, PC A08/MF A01. Order Number DE83900817.

Portions of document are illegible.

The information presented in this report is drawn from an extensive review of the existing literature concerning the various aspects of acid deposition. Additionally, key researchers involved in the study of acid deposition were interviewed to obtain the most current data available and to resolve, if possible, questions generated by the literature review. These data were placed into perspective, with respect to Texas, by a multidisciplinary team of experts having extensive experience in the state. The available body of knowledge suggests that acid deposition is not a problem of immediate concern throughout most of Texas. The potential for a problem in the future may exist, however, in parts of east Texas where acid precipitation has been monitored and where the most sensitivity to potential acid deposition effects are found.

13034 **Foreseeable effects of CO_2-induced climatic change: freshwater concerns.** Coutant, C.C. (Oak Ridge National Lab., TN). *Environmental Conservation;* 8: No. 4, 285-297(Win 1981). Contract W-7405-ENG-26.

This paper desribes freshwater ecological issues that seem needful of investigation and quantitative forecasting as society debates the prudence of adding more and more CO_2 to the atmosphere through fossil-fuel burning. The paper has been written with a minimum of background reviewing in order to focus on the issues, the logic behind them, and suggested research approaches. Necessary facilities, professional talents, and institutional support-structures, are all outlined, and time-frames are suggested where this has been feasible. The question of priority among the research issues is addressed, with consideration of the need for the research, its timing, and the feasibility of doing it. The assessment was orginally conducted as part of a broader study of research needs related to expected CO_2-induced climatic change.

13035 **On the mechanisms that control vertical ozone flux to vegetative surfaces.** Eastman, J.A. (Argonne National Laboratory, Argonne, IL); Wesely, M.L. (Michigan, University, Ann Arbor, MI). pp 462-470 of Quadrennial international ozone symposium. Vol. 1. Boulder, CO; International Association of Meteorology and Atmospheric Physics (1981).

From Quadrennial international ozone symposium; Boulder, CO, USA (4 Aug 1980).

It is noted that the recent development of a fast-response ozone sensor employing a chemiluminescent reaction with nitric oxide has made possible the measurement of the vertical flux of ozone using eddy correlation. Measurements made over mature soybean and maize show that the vertical ozone flux exhibits a strong diurnal trend, with the maximum ozone flux occurring between 10:00 and 15:00 hrs local time. Typical daily values of the maximum flux density over soybeans are notably large, approximately 1.5 x 10 to the 12th molecules/sq cm-sec, with occasional excursions approaching 4.0 x 10 to the 12th molecules/sq cm-sec. It is noted that these values correspond to deposition velocities of 1.0 and 1.4 cm/sec, respectively. The calculated bulk surface resistance shows good correlation with the ozone flux, indicating that the size of the stomatal aperture may be the predominant mechanism in the uptake of ozone at the surface. On windy nights the deposition velocities are about four times smaller than the daytime peaks, although they are still large enough to indicate that the uptake by soil under the soybean canopy is significant.

13036 **Comparison of ozone in polluted and clean air masses over Lake Michigan.** Alkezweeny, A.J.; Davis, W.E.; Easter, R.C. (Battelle Pacific Northwest Laboratories, Richland, WA). pp 616-623 of Quadrennial international ozone symposium. Vol. 1. Boulder, CO; International Association of Meteorology and Atmospheric Physics (1981).

From Quadrennial international ozone symposium; Boulder, CO, USA (4 Aug 1980).

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 13028, 13031, 13196

13037 **(DOE/OR/00033—T12) Supplemental stack-effluent monitoring at the Safety Light Corporation, Bloomsburg, Pennsylvania. Final report.** Frame, P.W. (Oak Ridge Associated Universities, Inc., TN (USA)). Nov 1982. Contract AC05-76OR00033. 26p. NTIS, PC A03/MF A01. Order Number DE83004580.

Supplemental stack effluent monitoring was performed at the Safety Light Corporation (SLC) in Bloomsburg, PA, on August 16 through 20, 1982. Monitoring of the SLC stack effluents at the point of relese indicated concentrations of aqueous tritium above the guideline levels established for unrestricted areas. However, environmental air sampling off-site indicated that the levels of all forms of tritium, including aqueous tritium, were well within the guidelines. Analyses performed by both the Oak Ridge Associated Universities (ORAU) and SLC of the stack effluents produced comparable results. It is concluded that the environmental tritium monitoring and control program established by SLC is adequate. Monitoring data are included.

13038 **(DPSPU—82-30-3) Interpretation of low-level environmental radioactivity measurements.** Zeigler, C.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant). 1982. Contract AC09-76SR00001. 12p. (CONF-820655—12). NTIS, PC A02/MF A01; 1. Order Number DE83004927.

From Health Physics Society annual meeting; Las Vegas, NV, USA (27 Jun 1982).

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Levels of radioactivity in the environment from worldwide fallout have decreased by about a factor of 10 since the early 1970's and many environmental concentrations are now less than the routine estimated lower limit of detection. To accurately represent these data and to assist in evaluating very low levels of radioactivity, each instrumental value with its statistical counting error should be reported. In some instances the background count of the instrument exceeds the sample count resulting in a value that is less than zero (a negative concentration). Evaluation of these negative numbers along with zero and positive concentrations over a suitable sample population can yield important information about concentrations that are less than routine minimum levels of detection. Actual instrumental values (negative, zero and positive) with associated statistical counting errors have been reported by the Environmental Monitoring Group at the Savannah River Plant since 1977. Methods for evaluating these data are discussed and empirical data presented to illustrate important points.

13039 **(EGG—1183-1837) Aerial radiological survey of the Comanche Peak Steam Electric Station and surrounding area, Glen Rose, Texas. Date of Survey: March 1982.** (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1982. Contract AC08-76NV01183. 13p. NTIS, PC A02/MF A01. Order Number DE83005108.

An aerial radiological survey was performed from 1 to 9 March 1982 over a 260-square-kilometer area centered on the Comanche Peak Steam Electric Station located in Somervell County, Texas. The survey was conducted by the Energy Measurements Group of EG & G for the US Nuclear Regulatory Commission. All gamma ray data were collected by flying parallel lines spaced 152 meters (500 feet) apart at an altitude of 91 meters (300 feet) above ground level. Count rates obtained from the aerial platform were converted to total exposure rates at 1 meter above the ground and are presented in the form of an isoradiation contour map. The observed exposure rates ranged from 6 to 12 microroentgens per hour (μR/h), with the average background ranging from 6 to 8 μR/h. These values include an estimated cosmic ray contribution of 3.8 μR/h. The exposure rates obtained from ground-based measurements taken in typical background locations within the survey area displayed positive agreement with the aerial data.

13040 **(KFK—3209) Investigation of the influence of modified parameters in the atmospheric dispersion model on the results of the German Risk Study (DRS).** Vogt, S.; Wittek, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Apr 1982. 18p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750932.

A substantial criterion in preparing Phase A of the German Risk Study was its comparability with the U. S. Reactor Safety Study. Therefore, a number of basic assumptions and methodological principles were to be identical with those adopted in the American study. For Phase B of the German Risk Study improvements of the method will be used to a greater extent and recent results of research work taken into account. A first step in this direction will consists in investigating the influence exerted by modified parameters in the dispersion submodel. The other parameters, besides dry and wet deposition, are the height of the mixing layer, the dispersion parameters and the wind direction. Furthermore, the degree will be studied at which the selection of weather sequences have an influence on the collective risks. All results indicated will be related to the results obtained in Phase A.

13041 **(KFK—3227B) Monitoring for environmental radioactivity at the Karlsruhe Nuclear Research Center in 1980.** Winter, M.; Schartz, R.; Tachlinski, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Apr 1982. 89p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82750931.

Part 1 of this report (extract of chapter 5.3 from KfK Report 3113) is a summarizing representation of measured results obtained in 1980. The routine environmental monitoring program as approved by the competent supervising authority of the state of Baden-Wuerttemberg was tabulated in Part 2. The comprehensive data section (Part 3) of the report contains all the individual measurement results from the routine measurement program. The measured values prove that in 1980 operation of the nuclear facilities of the Center caused at no time an inadmissible radiation burden on the population living in the vicinity.

13042 **(LA-UR—82-3488) Capabilities of the Los Alamos National Laboratory's environmental emergency-response vehicle.** Van Etten, D.; Talley, D.; Buhl, T.; Hansen, W. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 5p. (CONF-821215—3). NTIS, PC A02/MF A01. Order Number DE83004728.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

A 4-wheel drive van has been outfitted for rapid and varied monitoring response to radiological emergencies. The vehicle's capabilities include 4-wheel drive plus auxiliary winch for access to rugged off-road terrain. On-board equipment is powered by a 6.5 kilowatt ac generator or by external ac power where available. Monitoring systems include two multichannel analyzers; one, a 2 K portable analyzer with intrinsic germanium detector, the second, a microprocessor based 4 K analyzer with a swivel head intrinsic germanium detector. Rapid gamma searches are performed with a delta rate meter system using a chart recorder and two 4″ x 4″ x 16″ NaI detectors. Other equipment includes portable high volume air samplers and a portable phoswich, as well as the usual portable radiation survey instruments. The construction is modular so that equipment racks, detectors, AC generator and other major structures can be removed or replaced in a matter of minutes.

13043 **(LA-UR—82-3681) Measurements and modeling of gamma absorbed doses due to releases from a linear proton accelerator: experimental design and preliminary results.** Bowen, B.M.; Buhl, T.E.; Dewart, J.M.; Hansen, W.R.; Talley, D.; Chen, A.I.; Olsen, W.A.; van Etten, D.M. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 11p. (CONF-821215—7). NTIS, PC A02/MF A01. Order Number DE83004746.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

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External radiation levels due to positron annihilation radiation from ^{11}C, ^{13}N, and ^{15}O released by the 800 MeV linear proton accelerator at the Los Alamos Meson Physics Facility (LAMPF) have been monitored at a fence-line location both by thermoluminescent dosimeters (TLDs) and high pressure ionization chambers (HPICs). The accelerator is located in irregular terrain consisting of mesas and canyons. Fifteen-minute, accumulated external radiation levels were recorded with the HPICs. Instruments on a nerby meteorological tower concurrently measured wind speed and direction at three levels, temperature at two levels, solar radiation, and rainfall. Real-time radionuclide release rates and stack velocities were measured at the release point with in-stack monitors. This paper presents analyses of short-term radiation levels using HPICs and long-term levels using TLDs. Work being done to develop a computer model to predict external radiation levels based on meteorological data is also discussed.

13044 **(NUREG/CR—3004) Evaluation of experiences in long-term radon and radon-daughter measurements.** Young, J.A.; Jackson, P.O.; Thomas, V.W. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 41p. (PNL—4509). NTIS, PC A03/MF A01 - GPO $4.75. Order Number DE83004570.

Pacific Northwest Laboratory (PNL) is performing side-by-side measurements of radon and radon daughter concentrations using several instruments and techniques, and is comparing these measurements with side-by-side measurements made by other investigators at other locations. The standard deviation of the differences between the (natural) logarithms of the Terradex Track Etch radon concentrations and the logarithms of the Radon Progency Integrating Sampling Units (RPISU) radon daughter concentrations (S.D.-ln) measured in 50 buildings in Edgemont, South Dakota, was 0.37. Using this S.D.-ln, it can be calculated that if the Track Etch radon daughter concentration is 0.010 WL there should be only a 14% probability that the RPISU average would be greater than 0.015 WL, and only a 3% probability tht the RPISU average would be greater than 0.020 WL. If buildings had been cleared from remedial action when the Track Etch averages were less than 0.10 WL, then about 61% of the buildings would have been cleared from remedial action, and only a few percent of these buildings would have actually had average RPISU concentrations greater than 0.015 WL. The S.D.-ln between the Track Etch radon measurements and the RPISU radon daughter measurements made by ALARA at Grand Junction, the PERM radon measurements and the MOD-225 radon daughter measurements made by Mound Facility at Canonsburg and Middlesex, and the PERM and Track Etch radon measurements made by Mound Facility at Salt Lake City were similar to the S.D.-ln between the Track Etch radon measurements and the RPISU radon daughter measurements at Edgemont.

13045 **(PNL-SA—10170) Contaminant migration and fate research at Pacific Northwest Laboratory.** Brown, S.M. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1982. Contract AC06-76RL01830. 5p. (CONF-820609—79). NTIS, PC A02/MF A01. Order Number DE83003646.

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

Research on the environmental fate of radionuclides, heavy metals, and toxic organic compounds has been underway for over 16 years at the Pacific Northwest Laboratory (PNL). This research has been directed along two lines: laboratory and field investigations into the fundamental physical, chemical and biological processes affecting contaminant migration and fate, and model studies which integrate the results of this process-level research into sound, proven assessment methodologies. Several selected areas of research that typify the work being conducted are reviewed briefly.

13046 **(PNL-SA—10213) Survey of HEPA filter experience.** Carbaugh, E.H. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1982. Contract AC06-76RL01830. 11p. (CONF-820833—18). NTIS, PC A02/MF A01. Order Number DE83002713.

From 17. DOE nuclear air cleaning conference; Denver, CO, USA (1 Aug 1982).

A survey of high efficiency particulate air (HEPA) filter applications and experience at Department of Energy (DOE) sites was conducted to provide an overview of the reasons and magnitude of HEPA filter changeouts and failures. Results indicated that approximately 58% of the filters surveyed were changed out in the three year study period, and some 18% of all filters were changed out more than once. Most changeouts (63%) were due to the existence of a high pressure drop across the filter, indicative of filter plugging. Other reasons for changeout included leak-test failure (15%), preventive maintenance service life limit (13%), suspected damage (5%) and radiation buildup (4%). Filter failures occurred with approximately 12% of all installed filters. Of these failures, most (64%) occurred for unknown or unreported reasons. Handling or installation damage accounted for an additional 19% of reported failures. Media ruptures, filter-frame failures and seal failures each accounted for approximately 5 to 6% of the reported failures.

13047 **(PNL-SA—10684) Characteristics of airborne plutonium resuspended from near-background aged surface-sources.** Sehmel, G.A. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 17p. (CONF-821136—7). NTIS, PC A02/MF A01. Order Number DE83003462.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Plutonium content in samples of airborne solids collected at five Hanford sites was determined in several experiments directed toward investigating resuspension processes for aged surface sources. Though airborne plutonium concentrations are extremely low, radiochemical technique sensitivities allow plutonium characterization to be considered as a function of host-particle diameter in samples of airborne solids. Plutonium concentrations and activity densities are a function of aerodynamic particle diameter, sampling height, wind speed, wind direction and plutonium isotopic ratios.

13048 **Validation of the atmospheric transport model: comparison of observed krypton-85 concentrations with those computed using a Gaussian plume model.** Raridon, R.J.; Murphy, B.D. (Oak Ridge National Lab., TN). *Proceedings of the Summer Computer Simulation Conference;* 219-223(1982). Contract W-7405-ENG-26.

From Proceedings of the 1982 summer computer simulation conference; Denver, Colorado, USA (19 Jul 1982).

Thirty monthly average ^{85}Kr concentrations measured at 13 sampling locations between 25 and 150 km from a quasicontinuous point source were used in a validation study of the Atmospheric Transport Model for Toxic Substances (ATM-TOX). Although the computed values tended to overestimate, more than 60% of them fell within a factor of 2 of the observed concentrations.

13040 **Pitfalls in air sampling for radioactive particulates.** Munson, L.F.; Hadlock, D.E.; Munson, L.H.; Robinson, P.D.; Gilchrist, R.L. (Pacific Northwest Lab., Richland, WA). pp 569-578 of Radiation hazards in mining: control, measurement, and medical aspects. Gomez, M. (ed.). New York, NY; American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (1981). Contract AC06-76RL01830.

From International conference on radiation hazards in mining: control, measurement, and medical aspects; Golden, CO, USA (4 Oct 1981).

All uranium mills are required to perform sampling and analysis for radioactive particulates in their gaseous effluent streams and in the environment. Pacific Northwest Laboratory was requested by the US Nuclear Regulatory Commission (NRC) to provide technical assistance to them for their Uranium Mill Health Physics Appraisal Program. In conducting appraisals, air sampling methods used at NRC-licensed mills were reviewed and several deficiencies noted. This paper includes only environmental and effluent particulate sampling although much of the information is applicable to both in-plant and environmental samples. First, the components of a proper sampling program are discussed; program objectives, program design, sampler design, analyses, quality assurance, and data handling. Then the specific deficiencies, or the pitfalls from the first 8 mill appraisals are discussed.

5005 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 12125, 12126, 13032, 13033, 13068

13050 **(CNEN-RT/PROT—(81)5) Annual meteorological report for 1979 for the EUREX site of Saluggia.** (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Mar 1981. 85p. (In Italian). Dep. NTIS, PC A. Order Number DE82903130.

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Tabulated and graphic meteorological data for 1979 are given for the EUREX site of Saluggia, Italy, along with a brief description of the climatological profile of the area. Information includes data on atmospheric precipitation, humidity, temperature, wind velocity, solar radiation, and thermal gradients. 5 references, 15 figures, 42 tables.

5006 Regulations

13051 (CONF-8203103—, pp 5p, Paper 14) **Bubbles, existing and new under the Clean Air Act.** Bromberg, J.P. 1982. NTIS, PC A09/MF A01.

From 4. annual symposium on industrial coal utilization; Cincinnati, OH, USA (31 Mar 1982).

The recognition that the total quantity of pollutants emitted by a source was more important than the emissions of the separate units gave rise to the adoption of the bubble policy wherein internal plant tradeoffs between units were allowed such that a total emission limit applied to an entire plant. This policy was first applied to existing sources, and later extended to PSD and nonattainment determinations. In this presentation we examine the potential environmental and cost benefits of expanding the present bubble policy to new sources.

51 ENVIRONMENTAL SCIENCES,

TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 11924

13052 **(CONF-8210105—1) Bird communities and vegetation structure in pine plantations of the southeastern Coastal Plain.** Kroodsma, R.L. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 24p. NTIS, PC A02/MF A01. Order Number DE83003482.

From Annual meeting of Southeastern Association of Fish and Wildlife Agencies; Jacksonville, FL, USA (31 Oct 1982).

Breeding birds and vegetation structure were studied in 11 pine plantations and 2 scrub oak plots on the Savannah River Plant near Aiken, South Carolina. In the pine plantations, bird density and species number were significantly correlated ($P < .05$) with the density of broad-leaved vegetation, most of which was present in the understory. Birds that nested on or near the ground were responsible for this correlation. Significant differences ($P < .05$) in birds were found among the 3 species of pines used in the plantations. The pine species, in decreasing order of bird density and species number, were loblolly (Pinus taeda), slash (P. ellioti), and longleaf (P. palustris). Bird populations were low in the scrub oak plots.

13053 **(FWS/OBS—80/46.2) Ecological characterization of the central and northern California coastal region. Volume II, Part 2. Species.** (Jones and Stokes Associates, Inc., Sacramento, CA (USA)). Oct 1981. 685p. Fish and Wildlife Service, Washington, DC 20240.

Portions of document are illegible.

Approximately 200 plant and animal species that live within the central and northern California coastal region have been designated as rare, endangered, threatened, or fully protected by the state or federal governments. Sport species that are hunted or fished, and commercial fish, shellfish, furbearers, and trees, and pest or fouling species are also described. Other plant or animal species included in this volume are dominant or characteristic species in their respective habitats. Information on distribution, abundance, resource use, and ecological characteristics is presented. Whenever data were available, a discussion of the natural and human factors affecting abundance and distribution of the species is included. The concept of limiting factors is important considering the potential threat to a species posed by man-made developments and habitat disturbance. Management techniques are also identified.

13054 **(FWS/OBS—80/47.1) Ecological characterization of the central and northern California coastal region. Volume III, Part 1. Habitats.** (Jones and Stokes Associates, Inc., Sacramento, CA (USA)). Oct 1981. 479p. Fish and Wildlife Service, Washington, DC 20240.

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Specific habitat types are identified within each of the five aquatic systems and the terrestrial system that were modeled in Volume II, Part 1. Aquatic areas were classified into five systems and many finer categories (habitat types); terrestrial areas were classified into 15 cover types and 46 habitat types. To examine a site-specific project, consult Volume IV for vegetation and surficial geology maps for distribution of habitats. Each habitat type includes a description of characteristic plants and animal species as well as food webs that identify the interrelationships among the species. Important habitat-specific abiotic processes and features that control habitat operations are discussed. Socio-economic activities which may infringe on the operation of the habitat type are also identified as well as land use categories.

13055 **(FWS/OBS—81/49) Florida atlas of breeding sites for herons and their allies: 1976-1978.** Nesbitt, S.A.; Ogden, J.C.; Kale, H.W. II; Patty, B.W.; Rowse, L.A. (Florida Game and Fresh Water Fish Commission, Tallahassee (USA); National Audubon Society, New York (USA). Research Dept.; Florida Audubon Society, Maitland (USA). Ornithological Research Div.). Aug 1982. 458p. Fish and Wildlife Service, Washington, DC 20240.

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The first atlas of heron colonies was published in 1978 (Osborn and Custer 1978) and covered the Atlantic coast from Maine to Florida for 1975 and 1976. This atlas is an update of heron colonies for the Atlantic coast of Florida and an initial heron colony coverage for the Florida gulf Coast and inland colonies, 1976 through 1978. Aerial surveys were conducted in April and mid-summer over the Florida peninsula, east of the Ochlockonee River. A total of 295 active nesting colonies, with 22 different species, were located in the three-year period. Colony locations are shown on 1:250,000 USGS maps and Florida county maps. Colony data forms follow each county map and include information on location, date of census, estimated number of nesting pairs, site description, nesting substrate and proximity to human development.

13056 **Long-term dynamics of forest ecosystems.** Shugart, H.H. Jr.; West, D.C. (Oak Ridge National Lab., TN). *American Scientist;* **69**: 647-652(Nov 1981). Contract W-7405-ENG-26.

The fundamental data for understanding the dynamics of forests are the diameters and species of the trees that make up the forest. Tree diameter changes for an individual tree as the tree grows. Over a given area, the statistical distribution of tree diameters changes as a complex consequence of tree birth, growth, and death. Because a forest is composed of many trees and because the number of factors affecting the life of each tree is large, realistic models of forest dynamics based on individual trees have developed only as computing power has become available. In this paper, models that simulate forest dynamics are treated by calculating the competitive interrelationships among trees in a restricted spatial unit--typically the gap in a forest canopy created by the death or removal of a large canopy tree. For this reason they are called gap models. Computer simulation models, which allow for numerous seedlings and the long lives of large trees, predict how forests will respond to different management techniques.(KRM)

13057 **A computer model of succession and fire response of the high-altitude Eucalyptus forest of the Brindabella Range, Australian Capital Territory.** Shugart, H.H. Jr. (Oak Ridge National Lab., TN); Noble, I.R. *Australian Journal of Ecology;* **6**: 149-164(1981). Contract W-7405-ENG-26.

The BRIND model, a computer model of the high altitude forests in the Brindabella Range near Canberra (Australian Capital Territory), is documented and the results of a series of tests on the model are provided. The BRIND model simulates a 1/12 ha forest stand by computing the growth of each individual tree in the stand. It considers establishment and death of trees on a tree-by-tree basis using stochastic functions. The model also simulates the effects of prescribed fire and wildfire on the forests. The model presently is restricted to southeasterly facing slopes (moist, sheltered situations) above 850 m in altitude. The model was found to simulate patterns of vegetation that resemble those of the forests of the Brindabella Range in both space and time. The successional pattern was found to be complex and to differ from classic theories of succession originating with Clements. Potential model applications are discussed.

13058 **Appearance of irregular tree canopies in nighttime high-resolution thermal infrared imagery.** Balick, L.K.; Wilson, S.K. (Los Alamos National Laboratory, Los Alamos, NM). *Remote Sensing of Environment;* **10**: 299-305(Dec 1980).

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 11691, 11692, 13028, 13045

13059 **(BNL—32255) Applications of nuclear technologies for in-vivo elemental analysis.** Cohn, S.H.; Ellis, K.J.; Vartsky, D.; Wielopolski, L. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 18p. (CONF-8210106—1). NTIS, PC A02/MF A01. Order Number DE83004604.

From Workshop on uses of nuclear analytical methods in metal toxicology; Upton, NY, USA (11 Oct 1982).

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Measurement facilities developed, to date, include a unique whole-body-counter, (WBC); a total-body neutron-activation facility (TBNAA); and a partial-body activation facility (PBNAA). A variation of the prompt-gamma neutron-activation technique for measuring total-body nitrogen was developed to study body composition of cancer patients and the effect of nutritional regimens on the composition. These new techniques provide data in numerous clinical studies not previously amenable to investigation. The development and perfection of these techniques provide unique applications of radiation and radioisotopes to the early diagnosis of certain diseases and the evaluation of therapeutic programs. The PBNAA technique has been developed and calibrated for in-vivo measurement of metals. Development has gone forward on prompt-gamma neutron activation for the measurement of cadmium, x-ray fluorescence (XRF) for measurement of iron. Other techniques are being investigated for in-vivo measurement of metals such as silicon and beryllium.

13060 **(DOE/ER/12017—6) Subsurface subsidence damage monitoring: acoustic tomography and microgravimetry.** Albright, J.N.; Halleck, P.M. (Los Alamos National Lab., NM (USA); Oregon State Univ., Corvallis (USA)). 1981. Contract AT06-82ER12017. 7p. NTIS, PC A02/MF A01. Order Number DE83004894.

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Both microgravimetry and crosshole acoustic tomography are means by which subsurface collapse and rock failure may be observed. We show results of calculations that predict changes in gravity and gravity gradient that result from void migration, bulking, and hydrology disruption due to room and pillar mining. Crosshole acoustic tomography holds promise for detecting and mapping changes in structure during subsidence. Commercially available logging tools, advances in theory, and recent field results strongly suggest tomographic surveys are now possible. Subsidence phenomena which may be located are faulting, joint separation, bed parting, water table changes, and formation outgassing.

13061 **(DOE/EV/10019—16-Vol.2) Research issues in grazing lands under changing climate. Volume 12, Part 16. Environmental and societal consequences of a possible CO_2-induced climate change.** Pendleton, D.F.; Van Dyne, G.M. (Colorado State Univ., Fort Collins (USA). Dept. of Range Science). Dec 1982. Contract AS01-79EV10019. 50p. NTIS, PC A03/MF A01. Order Number DE83004723.

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A study has been made of issues and researchable questions regarding the influence of potential CO_2-induced climatic change on grazing lands. Generalized scenarios of possible changes in climate in grazing land regions of the world were constructed based on published and ongoing investigations. These studies were of two general types: (i) general circulation climate, and (ii) analyses of historical data for periods which were warmer than average current conditions, based on the assumption that global warming can be expected. A review of scenarios derived from recent research suggests that surface temperature may increase and precipitation may decrease in some important grazing land regions of the world. Research needs related specifically to climate in grazing lands were discussed. In the second workship, scientists discussed individual abiotic, autotrophic, and heterotrophic processes. Potential studies of these processes which were discussed included (i) work in the laboratory and the field, (ii) modelling, and (iii) analysis and synthesis of existing data bases and scientific literature. Both biological and socio-economic issues were discussed. Several overall conclusions were derived including the following: a planned, time-phased, and integrated study would be desirable to obtain the greatest amount of information for the least amount of funding in future investigations; a relatively small interdisciplinary group should be assembled consisting of individuals with backgrounds in such areas as meteorology, plant ecology, animal ecology, range science, economics, sociology, and systems analysis, and should operate over perhaps 10 years and draw upon specific short-term contractual inputs.

13062 **(ORNL/TM—8374) Regional assessment of potential sensitivity of soils in the eastern United States to acid precipitation.** Olson, R.J.; Johnson, D.W.; Shriner, D.S. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 53p. NTIS, PC A04/MF A01. Order Number DE83005157.

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Areas in the eastern United States are evaluated for their sensitivity to acid deposition by combining county-level information on soil chemistry, bedrock geology, terrain characteristics, and land-use information. The report presents three sets of sensitivity maps that represent continuing refinements in the sensitivity criteria and available data bases. Criteria were developed in cooperation with the Canada-United States Transboundary Working Group to obtain comparable sensitivity maps for both countries. The final analysis covered the eastern 37 states and excluded the 1013 counties that are predominantly agricultural or urban. Soils are characterized for their potential to undergo acidification from acid deposition. The criteria are moderate pH and low cation exchange capacity. The one soil type meeting these criteria occurs extensively only in 16 counties in Nebraska. The soils characterization map also shows low pH soils (potential for aluminum leaching) and peat soils (potential for acidifying precipitation). Areas are also classified for their potential to reduce the acidity of acid deposition prior to the transfer of acid inputs to aquatic systems. Low soil pH, low soil sulfate adsorption capacity, bedrock with no buffering capacity, and steep terrain are factors associted with low potential to reduce acidity. Eight percent of the 2660 counties in the east were found to have low potential to reduce acidity with an additional 20% having moderate potential. Areas occur in northern Minnesota, Wisconsin, and Michigan; the New England states; parts of New York and Pennsylvania; the Appalachian mountains; and Florida.

13063 **Enhanced oil recovery: environmental issues and state regulatory programs.** Millemann, R.E.; Haynes, R.J.; Boggs, T.A.; Hildebrand, S.G. (Oak Ridge National Lab., TN). *Environment International;* 7: No. 3, 165-177(1982). Contract W-7405-ENG-26.

During 1977-78, Oak Ridge National Laboratory prepared environmental impact assessments for nine enhanced oil recovery (EOR) field demonstration projects located in six states and reviewed the oil regulations for all oil-producing states. These evaluations revealed some potentially important environmental impacts associated with EOR including (1) pollution of land and surface waters from spills or leaks of oil and brine or other chemicals, (2) loss of biota, (3) excessive erosion and sedimentation (mostly in hilly terrain) and subsequent deterioration of surface-water quality, (4) contamination of groundwater, and (5) excessive air emissions from thermal operations. Potential groundwater impacts include (1) production of toxic and carcinogenic substances from synergistic interaction among chemicals used primarily in the micellar-polymer flooding technique, (2) formation of acid waters with small amounts of oil and metal residues and oxides from in situ combustion, and (3) corrosion of well casings and potential leaks of hydrogen sulfide primarily from injection of miscible carbon dioxide. The need for additional environmental planning and monitoring requirements specific to the oil-production industry is emphasized. States are encouraged to continue strengthening and upgrading their oil-regulatory programs to safeguard the environment. More studies are needed on (1) toxicity and carcinogenicity of chemicals used in injection processes, (2) evaluation of groundwater monitoring methods, and (3) reclamation procedures for soils contaminated by oil and brine.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11901, 11920, 11922, 13013, 13028, 13039, 13041, 13042, 13043, 13140

13064 **(EGG—1183-1824) Aerial radiological survey of the Argonne National Laboratory and surrounding area, Argonne, Illinois. Date of survey: May 1977.** (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1982. Contract AC08-76NV01183. 28p. NTIS, PC A03/MF A01. Order Number DE83005109.

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An aerial radiological survey was conducted over the facilities of the Argonne National Laboratory in Argonne, Illinois, on 2 to 13 May 1977. The survey was flown at an altitude of 46 m by a helicopter containing 20 sodium iodide detectors. The line spacing was also 46 m. Enhanced gamma exposure rate levels, which could be attributed to Argonne operations, were observed at many locations.

13065 **(LA-UR—82-3500) Texas Panhandle soil-crop-beef food chain for uranium: a dynamic model validated by experimental data.** Wenzel, W.J.; Wallwork-Barber, K.M.; Rodgers, J.C.; Gallegos, A.F. (Los Alamos National Lab., NM (USA); New Mexico Highlands Univ., Las Vegas (USA)). 1982. Contract W-7405-ENG-36. 12p. (CONF-821215—5). NTIS, PC A02/MF A01. Order Number DE83004730.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

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Long-term simulations of uranium transport in the soil-crop-beef food chain were performed using the BIOTRAN model. Experimental data means from an extensive Pantex beef cattle study are presented. Experimental data were used to validate the computer model. Measurements of uranium in air, soil, water, range grasses, feed, and cattle tissues are compared to simulated uranium output values in these matrices when the BIOTRAN model was set at the measured soil and air values. The simulations agreed well with experimental data even though metabolic details for ruminants and uranium chemical form in the environment remain to be studied.

13066 **(ORNL/TM—8479) Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory.** Alexander, W.A.; Oakes, T.W.; Eldridge, J.S.; Huang, S.; Hubbard, H.M. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 32p. NTIS, PC A03/MF A01. Order Number DE83005159.

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Ninety-two samples at varying depths were collected from 25 cores. Sample tubes were driven into the ground and segments of soil cores were retrieved at depths from the ground surface to subsurface consolidated material. forty samples of the 92 collected had detectable gamma activities [i.e., $> 2 \times 10^{-2}$ Bq/g (0.5 pCi/g)] of ^{137}Cs. However, only four samples, all from the same borehole, were found to have significant amounts of ^{137}Cs with a maximum of 1.7×10^{3} Bq/g (4.6×10^{4} pCi/g). These four samples also contained the highest activities of other radionuclides (^{60}Co, ^{90}Sr, ^{235}U, ^{238}U, ^{239}Pu, and ^{241}Am). These subsamples came from core number 4DD, which was the deepest core collected. Core 4DD was taken at the southwest corner of the site, which is at the lower elevation of the site. Since most of the activity in this core was found below the bedrock (or shale) in the groundwater region, the contamination is probably not from Building 3505. Additional investigation in the area around core location 4DD will be required to determine the extent of contamination.

13067 **Stack-released plutonium in the terrestrial environment of a chemical separations facility.** Corey, J.C.; Pinder, J.E. III; Watts, J.R.; Adriano, D.C.; Boni, A.L.; McLeod, K.W. (Savannah River Ecology Lab., Aiken, SC). *Nuclear Safety;* 23: No. 3, 310-319(May 1982).

Data collected at the Savannah River Plant provide the basis for an understanding of the behavior of plutonium released in the vicinity of a chemical separations plant. Deposition of stack-emitted plutonium on soil and vegetation surfaces varies as the inverse of the distance from the release point. Concentrations measured in food crops show that surface deposition contributes much more plutonium to the edible portions than does uptake by roots. The major dose to man from agricultural land use results from resuspension of surface plutonium and subsequent inhalation during soil tillage operations. Detailed flow diagrams describing the transport of plutonium through ecosystems are being developed. These data allow evaluation of hazards to man from ingestion and inhalation of plutonium-bearing particles.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 11921, 12125

13068 (FWS/OBS—80/46.1) Ecological characterization of the central and northern California coastal region. Volume II, Part 1. Regional characterization. (Jones and Stokes Associates, Inc., Sacramento, CA (USA)). Oct 1981. 453p. Fish and Wildlife Service, Washington, DC 20240.

Portions of document are illegible.

The volume serves two purposes. First, it is a transition between the basic concepts and models described in Volume I and the more specific information found in the rest of the volumes. It applies these basic concepts to the central and northern coastal California study area. Secondly, it provides an overview of the environmental setting of the study area. The wide diversity of the study area is revealed in discussions on climatic conditions; geology and soils; land use and population distribution; plants, animals and their habitats; economic and employment conditions; resources, and many other topics. All of the important physical-chemical features and processes that form, control, or influence the central and northern California coastal region are outlined. Major topics included geological, physical, and chemical oceanography; estuarine processes; hydrology and water quality; climatology and air quality; and geology and seismology. Models of each of the major kinds of systems are used - marine, estuarine, riverine, lacustrine (lakes), palustrine (shallow ponds), and terrestrial - to characterize the biological environment of the study area. Each model shows the interrelationships among physical-chemical, biological, and socio-economic features and processes. Emphasis has been placed on the physical factors that control or influence biological features and processes. Important species and areas of ecological concern are identified. Important socio-economic features of the northern and central California coast are described, including forestry and forest products, fisheries, recreation, transportation and energy utilities, service activities, social and cultural features, and land use.

13069 (FWS/OBS—80/47.2) Ecological characterization of the central and northern California coastal region. Volume III, Part 2. Community composition lists. (Jones and Stokes Associates, Inc., Sacramento, CA (USA)). Oct 1981. 882p. Fish and Wildlife Service, Washington, DC 20240.

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An extensive listing of species for each habitat type is offered in this volume. Many thousands of plant and animal species are found within the central and northern California coastal region. Preparation of a useful list of species required identifying and recognizing the most common or characteristic species of the region. In addition to the common or characteristic plants and animals the list also included commercial, recreational, and rare, threatened, endangered, and fully protected species. An annotated species data entry form was prepared for each species chosen. Entries on the form included scientific and common names, taxonomic division, intermediate group name, distribution by watershed or basin, legal status, habitat, feeding habits, trophic level, abundance, habitat use, and literature references.

13070 (FWS/OBS—80/48.1) Ecological characterization of the central and northern California coastal region. Volume IV. Watersheds and basins. Chapters 1-16. (Jones and Stokes Associates, Inc., Sacramento, CA (USA)). Oct 1981. 703p. Fish and Wildlife Service, Washington, DC 20240.

Portions of document are illegible.

Central and northern coastal California is such a large and diverse region that it is subdivided into smaller units for ease in presenting site-specific information. A separate chapter was prepared for each of 22 watersheds and five offshore basins, and each contains site-specific information. Chapters on the watersheds contain information on terrestrial, freshwater, and estuarine physical-chemical processes and features, biological resources, and socio-economic activities. Chapters about the basins contain information on intertidal, pelagic and subtidal benthic physical-chdmical processes and features, biological resources, and socio-economic activities. Watershed chapters contain descriptions of geology, soils, climate, tsunami hazard, hydrology, water quality, and other topics. The biological resources section of each watershed description contains information on selected species and areas of ecological concern. Preserves, reserves, refuges, conservation areas, sites of known scientific and educational value, anadromous fish spawning areas, wild and scenic rivers, important nesting sites, and waterfowl and shorebird concentrating locations are described and mapped as areas of ecological concern. Socio-economic descriptions include land use, economics, population, environmental issues and other topics, both existing data and trends. The basin chapters contain similar kinds of information but with a greater emphasis on substrate distribution maps.

13071 (FWS/OBS—80/48.2) Ecological characterization of the central and northern California coastal region. Volume IV. Watersheds and basins. Chapters 17-29. (Jones and Stokes Associates, Inc., Sacramento, CA (USA); Anatec Labs., Inc., Santa Rosa, CA (USA); EDAW, Inc., San Francisco, CA (USA); White (E.H.) and Co., Inc., San Francisco, CA (USA); Environmental Science Associates, Foster City, CA (USA); Kinnetic Labs., Inc., Santa Cruz, CA (USA); Madrone Associates, Novato, CA (USA)). Oct 1981. 695p. Fish and Wildlife Service, Washington, DC.

Portions of document are illegible.

Central and northern coastal California is such a large and diverse region that it is subdivided into smaller units for ease in presenting site-specific information. A separate chapter was prepared for each of 22 watersheds and five offshore basins, and each contains site-specific information. Chapters on the watersheds contain information on terrestrial, freshwater, and estuarine physical-chemical processes and features, biological resources, and socio-economic activities. Chapters about the basins contain information on intertidal, pelagic and subtidal benthic physical-chemical processes and features, biological resources, and socio-economic activities. Watershed chapters contain descriptions of geology, soils, climate, tsunami hazard, hydrology, water quality, and other topics. The biological resources section of each watershed description contains information on selected species and areas of ecological concern. Preserves, reserves, refuges, conservation areas, sites of known scientific and educational value, anadromous fish spawning areas, wild and scenic rivers, important nesting sites, and waterfowl and shorebird concentrating locations are described and mapped as areas of ecological concern. Socio-economic descriptions include land use, economics, population, environmental issues and other topics, both existing data and trends. The basin chapters contain similar kinds of information but with a greater emphasis on substrate distribution maps.

13072 (NP—3901050) Land use/mineral rights map series. Lineback, N.G.; Weaver, D.C. (Alabama Univ., University (USA). School of Mines and Energy Development). Sep 1982. 15p. NTIS, PC A02/MF A01. Order Number DE83901050.

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The ongoing Land Use/Mineral Rights Map Series was designed to map the existing land uses and mineral rights in and around the Warrior Coal Basin. The map series provides baseline data for monitoring all land use changes in the Warrior Basin and for establishing a record of mineral rights useful in classifying some record discrepancies and assisting the mining industry and its regulatory agencies in organizing mineral rights data. Ten additional maps were completed during this 1981-82 funding period. Virtually all large mining and leasing companies in the Basin now have standing orders for all new maps, and orders for existing maps are being received weekly.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 13020, 13053, 13054

13073 **(CONF-821152—1) Model of naticid gastropod predator-prey coevolution.** DeAngelis, D.L.; Kitchell, J.A.; Post, W.M.; Travis, C.C. (Oak Ridge National Lab., TN (USA); Wisconsin Univ., Madison (USA). Dept. of Geology and Geophysics). 1982. Contract W-7405-ENG-26. 20p. NTIS, PC A02/MF A01. Order Number DE83004645.

From International symposium on mathematical ecology; Trieste, Italy (29 Nov 1982).

Size change over evolutionary time between two interacting species, a predatory naticid gastropod and its bivalve prey, is analyzed. We show that two simultaneous, maximizing algorithms (the predator maximizes energy intake; the prey maximizes reproductive output) result in an endogenous, coevolutionary size increase, to a stable attracting point. In particular, we show that selection for delayed reproduction in a predatorpreay system that is highly size-selective due to the predatory strategy of cost-benefit prey selection, coupled with the relative allometries of cost (prey shell thickness) and benefit (prey biomass) with prey size, and the highly size-dependent probability of successful predation, lead to a coevolutionary size increase for both predator and prey, up to a limit condition dictated by predatory respiration costs. In the absence of predation, the prey species attains a smaller size than in the presence of predation. Addition of the predator results in a delay in the timing of reproduction by the prey, thereby facilitating a size response.

13074 **(LA—9445-PNTX-B) Supplementary documentation for an environmental impact statement regarding the Pantex Plant: hydrologic study for the Iowa Army Ammunition Plant.** Becker, N.M. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 15p. NTIS, PC A02/MF A01. Order Number DE83004950.

This report documents work performed in support of preparation of an Environmental Impact Statement (EIS) regarding the Department of Energy's Pantex Plant near Amarillo, Texas. A study of flooding was made for the Iowa Army Ammunition Plant near Burlington, Iowa, one of the alternative sites. A partial series-flood frequency analysis of the Skunk River, which flows along the plant's southern boundary, was examined as well as the effects of rise in river level of the Skunk River on the plant and its operations. A flood frequency analysis on Long Lake, a manmade reservoir within the plant grounds, was made. Maximum spillway capacity was computed and compared to the magnitude of floods of particular recurrence intervals.

13075 **Organic energy budget of Rattlesnake Springs, Washington.** *American Midland Naturalist;* **107**: No. 2, 404-407(1982). Contract AC06-76RL01830.

Calculation of organic energy budgets has become a widely used method to compare lotic ecosystems and ecosystem functioning. Fisher and Likens included import and export of particulate organic matter (POM) with the parameters of production (P) and respiration (R), providing stream ecologists an added refinement in characterizing the trophic basis of streams. An annual organic energy budget for Rattlesnake Springs showed the system to be autotrophic as measured by the P/R ratio (P/R = 1.38). In terms of detrital processing, however, the system was a net importer on an annual basis despite one major export (remissive) event. Suggestions are made concerning the expression and comparison of annual stream energy budgets.

13076 **Larval mortality from offshore mixing as a link between precompetent and competent periods of development.** Jackson, G.A. (Univ. of California, San Diego, La Jolla); Strathmann, R.R. *American Naturalist;* **118**: No. 1, 16-26(Jul 1981). Contract AM03-76SF00010.

A model of larval dispersal of coastal benthic invertebrates is proposed: Eddy mixing spreads larvae in the onshore-offshore direction during the period before competence to settle and continues to take larvae both onshore and offshore after they are competent to settle; predators kill larvae during both precompetent and competent periods. Distribution of larval stages of several species are consistent with the model. The model correctly predicts (1) increased competent period with increased precompetent period in comparisons among species, and (2) a competent period greater or equal to the precompetent period. The model predicts a decrease in the ratio of competent to precompetent period as precompetent period increases, which is not apparent in available data. Also, some observed competent periods are longer than those predicted by the model. Reasons for these departures from predictions are suggested. The model differs from previous optimization or maximization models for planktonic larvae by including onshore-offshore mixing and therby linking selection on the precompetent and competent periods.

13077 **Distribution and abundance patterns of rocky intertidal fishes in central California.** Yoshiyama, R.M. (Stanford Univ., CA). *Environmental Biology of Fishes;* **6**: No. 3/4, 315-332(1981). Contract W-7405-ENG-26.

Distribution patterns and relative abundances were determined for rocky fishes in central California. Distributions were described relative to a categorization scheme of tidepools based on certain biotic and physical criteria. The fishes displayed a variety of distributions over tidepool categories and showed some segregation withing categories. Cottids were the predominant tidepool fishes encountered, with Oligocottus snyderi and Clinocottus analis comprising 62% of all cpatures. The cebidichthyid Cebidichthys violaceus and the stichaeid Anoplarchus purpurescens were also relatively common and dominated the out-of-water microhabit. Oligocottus snyderi showed a minor shift in distribution over tidepool categories between seasons, and C. analis showed none, but both species varied substantially in abundance.Temporal changes in abundance of the more common species indicated seasonal trends, but the duration of the census period was insufficient to verify this. It is concluded that while species interactions may have influenced the observed patterns of habitat partitioning, the roles of predation and competition cannot be unambiguously defined. Presently, neither these nor historical factors can be discounted from having significantly influenced of the evolution of the intertidal fish community.

13078 **Feeding selectivity of schools of northern anchovy, Engraulis mordax, in the Southern California Bight.** Koslow, J.A. (Univ. of California, San Diego). *Fishery Bulletin;* **79**: No. 1, 131-142(1981). Contract AM03-76SF00010.

Direct field measurements of the feeding of five schools of northern anchovy over four sets of conditions indicate consistent size-selective feeding on the dominant zooplankton taxa. At low-to-moderate prey concentrations (10 to 40 mg carbon per cubic meter), the schools consumed 35 to 50% of the total zooplankton biomass and > 90% of the largest zooplankters present. The schools' feeding was a positive function of prey size primarily. The density of particular prey items did not significantly affect feeding selectivity. The northern anchovy fed preferentially upon a particular species in only one instance. No significant difference was found in the selectivity of two northern anchovy schools composed primarily of late 0-group and II-group fish, respectively, that were feeding under similar feeding conditions. At prey concentrations of 10 to 40 mg carbon per cubic meter, the degree of selectivity was inversely related to the size of the largest prey available. The prey size at which consumption is predicted to be 100% was proportional to the size of the largest prey.

13079 **Light, temperature and nitrogen as interacting factors affecting diel vertical migrations of dinoflagellates in culture.** Heaney, S.I.; Eppley, R.W. (Univ. of California, San Diego). *Journal of Plankton Research;* **3**: No. 2, 331-343(1981).

Diel vertial migrations of the marine dinoflagellates Gonyaulax polyedra Stein and Ceratium furca (Ehr.) Clap. et Lachm, were followed in a laboratory tube (2.02 m x 0.25 m) under a 12:12h light:dark cycle. The effects of temperature stratification, two levels of surface irradiance and nitrogen depletion on patterns of vertical migrations were examined. At temperatures between 22 to 26°C with small temperature gradients, both species migrated at a rate of 0.7 to 1.0 mh^{-1}. Steeper thermoclines (ca. 0.8°C 0.1 m^{-1}) with temperatures below ca. 20°C caused a marked decrease in swimming speed which resulted in accumulations of cells in these thermocline regions. Under conditions of nutrient sufficiency both algae migrated into the surface layers at irradiance values of over 1000 μE $m^{-2}s^{-1}$. Increasing nitrogen depletion caused the downward migration of both algae to commence progressively earlier in the day and

before the end of the light period. The earlier downward migrations enabled a more complete descent through the thermocline. Nitrogen depleted cells of Gonyaulax continued to undertake vertical migrations but avoided high irradiances thus forming sub-surface maxima at irradiance levels close to 150μE $m^{-2}s^{-1}$. Ceratium cells which exhausted both inorganic nitrogen and phosphorus ceased to migrate accompanied by a large change in cellular fluorescence.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 11691, 11692, 13028, 13029, 13063, 13092, 13200

13080 **(DOE/EV/10502—3) Flare system for safe disposal of LNG from a disabled tanker.** (Little (Arthur D.), Inc., Cambridge, MA (USA)). Dec 1982. Contract AC01-81EV10502. 63p. NTIS, PC A04/MF A01. Order Number DE83005114.

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The feasibility of a flare system for the rapid and safe incineration of the cargo of a disabled LNG tanker is evaluated. The project developed design parameters and proof-of-principle investigations of a system for off-loading and flaring LNG from a disabled LNG tanker. The system described offers enough promise to warrant additional investigation, if cargo burning is desired as a way of reducing other possible hazards.

13081 **(DOE/EV/10611—2) Increase of total CO_2 in the world oceans. Annual progress report.** Chen, C.T.A. (Oregon State Univ., Corvallis (USA). School of Oceanography). 3 Sep 1982. Contract AT06-81EV10611. 6p. NTIS, PC A02/MF A01. Order Number DE83004868.

During the past quarter new instrumentation was developed, library samples collected from the previous contract year were analyzed, and samples have been collected from two cruises, one in the Weddell Sea (October 9 to November 26, 1981) and one in the north Pacific Ocean (May 27 to June 29, 1982). The major accomplishments are described briefly.

13082 **Evaporation of phenols from synthetic liquid fuel spills.** Southworth, G.R. (Oak Ridge National Lab., TN). *Environment International;* 7: No. 3, 203-206(1982). Contract W-7405-ENG-26.

The environmental impact of a synthetic-fuel spill on a waterway will be determined in part by the rate of dissolution of toxic components into the underlying water and by the rate of removal of those components from the oil by evaporation. In this study, the two film mass transfer model of volatilization was applied to the study of the evaporation of phenols from two synthetic liquid fuels. The rates of evaporation of phenol and alkylated phenols were measured under laboratory conditions. Liquid and gaseous mass transfer coefficients were measured experimentally, and used to calculate Henry's Law coefficients for various phenol-oil pairs from the observed evaporation rates. It was concluded that evaporation rates of phenols from synthetic oils would be significantly less than rates of dissolution in most spills.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 11909, 11915, 11923, 11925, 11926, 13037, 13038, 13045, 13196, 13200

13083 **(DOE/EV/10306—T3) Integrative study of the behavior of transuranic elements in the marine environment. Progress report, June 1, 1982-May 31, 1983.** Choppin, G.R.; Morse, J.W. (Florida State Univ., Tallahassee (USA); Texas A and M Univ., College Station (USA)). 1983. Contract AS05-79EV10306. 45p. NTIS, PC A03/MF A01. Order Number DE83003872.

The adsorption of actinides from marine solutions into sediments was studied to model the distribution and speciation of transuranic elements in the marine environment. The basic plan involves measuring the complexity and hydrolysis constants of actinides in oxidation states III to VI and studying a limited number of common sediment components to determine which factors determine the partitioning of actinides among these components. Individual sediment components then will be combined in synthetic sediments of increasing complexity and the distributions studied between these sediments and solutions.

13084 **(EPA—570/9-82-003) Methods of removing uranium from drinking water. I. A literature survey. II. Present municipal water treatment and potential removal methods.** Drury, J.S.; Michelson, D.; Ensminger, J.T.; Lee, S.Y.; White, S.K.; Bondietti, E.A. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 101p. (ORNL/EIS—194). NTIS, PC A06/MF A01. Order Number DE83005166.

This report is divided into two sections, each of which was abstracted and indexed for EDB/ERA/INIS. (JGB)

13085 (EPA—570/9-82-003, pp 40p, Paper 1) **Literature survey.** Drury, J.S.; Michelson, D.; Ensminger, J.T. Dec 1982. NTIS, PC A06/MF A01.

In Methods of removing uranium from drinking water. I. A literature survey. II. Present municipal water treatment and potential removal methods.

Literature was searched for methods of removing uranium from drinking water. No relevant papers were found, but approximately 1000 publications were identified in a less specific search for methods of removing uranium from water. Most of the latter publications dealt with the recovery of uranium from ores, industrial and analytical chemistry solutions, or seawater. The conditions under which these studies were performed were usually quite different from those normally occurring in municipal water treatment practice, but some potentially interesting systems of recovery were identified. A few papers addressed the problem of removing uranium from natural fresh waters and established the effectiveness of using adsorbents or coprecipitants, such as aluminum hydroxide, ferric hydroxide, activated carbon, and ion exchangers, under certain conditions. Also, many US manufacturers and users of water treatment equipment and products were contacted regarding recommended methods of removing uranium from potable water. Based on the results of these surveys, it is recommended that untreated, partially treated, and finished water samples from municipal water treatment facilities be analyzed to determine their extent of removal of uranium by presently used procedures. In addition, laboratory studies are suggested to determine what changes, if any, are needed to maximize the effectiveness of treatments that are already in use in existing water treatment plants.

13086 (EPA—570/9-82-003, pp 57p, Paper 2) **Present municipal water treatment and potential removal methods.** Lee, S.Y.; White, S.K.; Bondietti, E.A. Dec 1982. NTIS, PC A06/MF A01.

In Methods of removing uranium from drinking water. I. A literature survey. II. Present municipal water treatment and potential removal methods.

Uranium analyses of raw water, intermediate stage, and treated water samples from 20 municipal water treatment plants indicated that the present treatment practices were not effective in removing uranium from raw waters when the influent concentration was in the range of 0.1 to 16 μg/L uranium. Laboratory batch tests revealed that the water softening and coagulant chemicals commonly used were able to remove more than 90% of the dissolved uranium ($<$ 100 μg/L) in waters if an optimum pH and dosage were provided. Absorbents, titanium oxide and activated charcoal, were also effective in uranium removal under specific conditions. Strong base anion exchange resin was the most efficient uranium adsorbent, and an anion exchange column is a recommended option for the treatment of private well waters containing uranium at higher than desirable levels.

13087 (INIS-mf—7224) Environmental radioactivity in the Austrian section of the river Danube (1975-1979). Natural radioactivity and radiation in Austria. Proceedings of the 5. and 6. annual meeting of the OeSRAD. (Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna. Studiengruppe fuer Radioaktivitaetsmessungen im Donauraum (OeSRAD)). 1980. 185p. (In German). (CONF-7906247—; CONF-8005231—). NTIS (US Sales Only), PC A09/MF A01. Order Number DE83780197.

From 5. annual Austrian Study Group meeting for radioactivity measurements in the Danube; Vienna, Austria (1 Jun 1979). Individual papers are included in the data base. (PSB)

13088 (KFK—3074) Plutonium contamination of the 'Altrhein' river. Pimpl, M.; Schuettelkopf, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). May 1982. 27p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750928.

At five positions in 'Altrhein' river, sediment samples were collected. These sediment samples were divided into fractions of 0.8 mm, 0.1 to 0.8 mm, and < 0.1 mm particle diameter by sieving and rinsing. The < 0.1 mm fractions were divided into five subfractions by sedimentation analysis. In each sample diameter distribution and plutonium concentration were determined. The evaluation of the results received confirmed that plutonium contamination of sediment particles is a surface contamination and not a homogeneous contamination of the whole particle. Fractions with samller particles contain higher plutonium concentrations than fractions with larger particles.

13089 (NUREG/CR—2423) Mathematical simulation of sediment and radionuclide transport in estuaries. Onishi, Y.; Trent, D.S. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 72p. (PNL—4109). NTIS, PC A04/MF A01 - GPO $5.00. Order Number DE83004572.

The finite element model LFESCOT (Flow, Energy, Salinity, Sediment and Contaminant Transport Model) was synthesized under this study to simulate radionuclide transport in estuaries to obtain accurate radionuclide distributions which are affected by these factors: time variance, three-dimensional flow, temperature, salinity, and sediments. Because sediment transport and radionuclide adsorption/desorption depend strongly on sizes or types of sediments, FLESCOT simulates sediment and a sediment-sorbed radionuclide for the total of three sediment-size fractions (or sediment types) of both cohesive and noncohesive sediments. It also calculates changes of estuarine bed conditions, including bed elevation changes due to sediment erosion/deposition, and three-dimensional distributions of three bed sediment sizes and sediment-sorbed radionuclides within the bed. Although the model was synthesized for radionuclide transport, it is general enough to also handle other contaminants such as heavy metals, pesticides, or toxic chemicals. The model was checked for its capability for flow, water surface elevation change, salinity, sediment and radionuclide transport under various simple conditions first, confirming the general validity of the model's computational schemes. These tests also revealed that FLESCOT can use large aspect ratios of computational cells, which are necessary in handling long estuarine study areas. After these simple tests, FLESCOT was applied to the Hudson River estuary between Chelsea and the mouth of the river to examine how well the model can predict radionuclide transport through simulating tidally influenced three-dimensional flow, salinity, sediment and radionuclide movements with their interactions.

13090 (NUREG/CR—2425) Sediment and radionuclide transport in rivers: radionuclide transport modeling for Cattaraugus and Buttermilk Creeks, New York. Onishi, Y.; Yabusaki, S.B.; Kincaid, C.T.; Skaggs, R.L.; Walters, W.H. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 387p. (PNL—4111). NTIS (US Sales Only)- GPO $9.50. Order Number DE83005005.

Mf only; illegibility does not permit PC reproduction.

SERATRA, a transient, two-dimensional (laterally-averaged) computer model of sediment-contaminant transport in rivers, satisfactorily resolved the distribution of sediment and radionuclide concentrations in the Cattaraugus Creek stream system in New York. By modeling the physical processes of advection, diffusion, erosion, deposition, and bed armoring, SERATRA routed three sediment size fractions, including cohesive soils, to simulate three dynamic flow events. In conjunction with the sediment transport, SERATRA computed radionuclide levels in dissolved, suspended sediment, and bed sediment forms for four radionuclides (^{137}Cs, ^{90}Sr, $^{239,240}Pu$, and ^{3}H). By accounting for time-dependent sediment-radionuclide interaction in the water column and bed, SERATA is a physically explicit model of radionuclide fate and migration. Sediment and radionuclide concentrations calculated by SERATA in the Cattaraugus Creek stream system are in reasonable agreement with measured values. SERATRA is in the field performance phase of an extensive testing program designed to establish the utility of the model as a site assessment tool. The model handles not only radionuclides but other contaminants such as pesticides, heavy metals and other toxic chemicals. Now that the model has been applied to four field sites, including the latest study of the Cattaraugus Creek stream system, it is recommended that a final model be validated through comparison of predicted results with field data from a carefully controlled tracer test at a field site. It is also recommended that a detailed laboratory flume be tested to study cohesive sediment transport, deposition, and erosion characteristics. The lack of current understanding of these characteristics is one of the weakest areas hindering the accurate assessment of the migration of radionuclides sorbed by fine sediments of silt and clay.

13091 (RHO-BW-SA—198-P) Radionuclide sorption of Columbia River basalt interbed materials. Barney, G.S. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). May 1982. Contract AC06-77RL01030. 43p. (CONF-8205100—2). NTIS, PC A03/MF A01. Order Number DE83004200.

From Whiteshell Nuclear Research Establishment symposium; Pinawa, Manitoba, Canada (21 May 1982).

Sorption and precipitation of key radionuclides in the groundwater-rock systems expected in Columbia River interbed zones were investigated. Sorption isotherms were defined for sorption of Ce, Sr, Se, Tc, Ra, U, Np, and Am on an interbed sandstone standard from the Rattlesnake Ridge interbed. In addition, the effect of groundwater composition and redox potential on sorption and precipitation of these radionuclides on interbed snadstone and tuff were studied. Isotherms were measured at 23°, 60°, and 85°C. The Freundlich equation accurately fits the isotherm data when precipitation does not occur. Solubility limits were obtained for Tc and Se using the isotherms. Sorption of Cs, Se, Tc, U, and Am is strongly affected by temperature over the 23° to 85°C range. The major chemical components of Grande Ronde groundwater (Na^+, Ca^{2+}, K^+, Mg^{2+}, Cl^-, F^-, CO_3^{2-}, HCO_3^-, and SO_4^{2-}) were studied for their influence on sorption and precipitation. Statistically designed experiments identified significant groundwater components and measured their effects. The results gave evidence for selecting sorption mechanisms for each radionuclide (ion exchange, chemisorption, redox reactions, complex formation, or precipitation). Strontium, Ra, and Cs are sorbed by ion exchange and compete for exchange sites with ions of similar size. The Np, Pu, and Tc are reduced by hydrazine to their (IV) oxidation states and are sorbed by chemisorption. Selenium is not reduced to the metal by hydrazine, but appears to be precipitated as a calcium compound. The groundwater variables had little effect on Am sorption. A slightly soluble Am compound appears to form which is more soluble at low pH.

13092 (UCRL—88425) On-line liquid-effluent monitoring of sewage at Lawrence Livermore National Laboratory. Dreicer, M.; Cate, J.L.; Rueppel, D.W.; Huntzinger, C.J.; Gonzalez, M.A. (Lawrence Livermore National Lab., CA (USA)). 2 Dec 1982. Contract W-7405-ENG-48. 10p. (CONF-821215—6). NTIS, PC A02/MF A01. Order Number DE83003880.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

An automatic on line sewage effluent monitoring system has been developed. A representative fraction of the total waste stream leaving the site is monitored for pH, radiation, and metals as it

passes through a detection assembly. This assembly consists of an industrial pH probe, NaI radiation detectors, and an x-ray fluorescence metal detector. A microprocessor collects, reduces and analyzes the data to determine if the levels are acceptable by established environmental limits. Currently, if preset levels are exceeded, a sample of the suspect sewage is automatically collected for further analysis, and an alarm is sent to a station where personnel can be alerted to respond on a 24-hour basis. Since at least four hours pass before LLNL effluent reaches the treatment plant, sufficient time is available to alert emergency personnel, evaluate the situation, and if necessary arrange for diversion of the material to emergency holding basins at the treatment plant. Information on the current system is presented, and progress is reported in developing an on-line tritium monitor as an addition to the assembly.

13093 **Models of the distribution of ^{210}Pb in a section across the North Equatorial Atlantic Ocean.** Spencer, D.W.; Bacon, M.P.; Brewer, P.G. (Woods Hole Oceanographic Inst., MA). *Journal of Marine Research;* **39**: No. 1, 119-138(1981). Contract AC02-76EV03566.

The deficiency of ^{210}Pb relative to ^{226}Ra in the world's deep ocean is well documented, and the overall residence time of ^{210}Pb has been calculated to be about 15 to 100 years. It has been assumed, generally, that the removal mechanism is one of in situ adsorption on settling particles, but Bacon et al. (1976) suggested that a boundary scavenging process with diffusive and advective fluxes of ^{210}Pb from the interior ocean may be a significant factor. In this contribution researchers examine some two-dimensional models of ^{210}Pb in a section across the North Atlantic Ocean at 15N. Researchers show that satisfactory fits to the ^{210}Pb distribution may be obtained with a model that includes both boundary scavenging and in situ adsorption with a constant adsorption rate constant or with a model that has no boundary scavenging but allows the in situ adsorption rate constant to be a function of distance from the boundary. Researchers have calculated the interior and boundary fluxes of ^{210}Pb required of each model and suggest that the boundary fluxes are of a magnitude to be compatible with Fe and Mn redox cycling in slope and shelf sediments but that the variations in the in situ adsorption flux are difficult to explain in terms of the known distributions of fine particles. Researchers suggest that the boundary scavenging process is a function of the flux of Fe^{+3} and Mn^{+3} from anoxic sediments accompanied by rapid oxidation and precipitation in the boundary mixed layers.The boundary fluxes calculated for model amount to 2 to 8 dpm cm^{-2} yr^{-1} for slope and shelf sediments but only about 0.04 dpm cm^{-2} yr^{-1} for the deep ocean bottom boundary. The bottom boundary flux in the deep ocean is small and would not be detectable above the large particle flux of about 017 dpm cm^{-2} yr^{-1} contributed by biological removal from the ocean surface.

13094 **Am-241/Pu-239 + 240 ratios in the marine environment.** Koide, M.; Williams, P.W.; Goldberg, E.D. (Scripps Inst. of Oceanography, La Jolla, CA). *Marine Environmental Research;* **5**: 241-246(1981). Contract AM03-76SF00034;AM03-76SF00010.

The Am-241/Pu-239 + 240 ratio is at least a factor of two higher in the particulate phases of California coastal waters than the values previously reported for unfiltered waters and sediments. These results are attributed to a greater water solubility for plutonium relative to americium species. The values of the ratio in mussels indicate primarily a particulate uptake of these transuranics. Sorption experiments of these two elements from seawater to glass beads, rayon fibres and filter papers are consistent with an uptake of the particulate phases.

13095 **(ORNL-tr—4893) Intake of ^{226}Ra by ingestion and its evaluation in a selected population group.** Ivan, J.; Slovak, M.; Abel, E.; Patzeltova, N. Translated from *Ceskoslovenska Hygiena ;* **21**: 382-386(1976). Contract W-7405-ENG-26. 11p. NTIS, PC A02/MF A01. Order Number DE83000075.

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The activity of ^{226}Ra was followed in drinking waters of Western Slovakian region and in the all-day-food. The volume activities of ^{226}Ra in drinking waters were in the range 0 to 63 $mBq.l^{-1}$ (0.0 to 1.7 $pCi.l^{-1}$) with a mean value 9.3 $mBq.l^{-1}$ (0.25 $pCi.l^{-1}$). The average activity of ^{226}Ra in the food, as expressed per person and day, was 47.7 mBq (1.29 pCi). The total intake of ^{226}Ra by ingestion in the observed group, also calculated per person and day was on the average 57 mBq (1.54 pCi). The value found was used for the evaluation of the group exposure of subpopulation, represented by members of a university catering establishment. Since a homogenous group was observed, the values obtained indicate an average exposure to ^{226}Ra in the members of public catering establishments. The calculated values for the annual dose equivalent of ^{226}Ra to the skeleton in adults were 2.48 mrem, with the corresponding commitment of dose equivalent being 0.119 rem; these values are small in view of the above-mentioned annual ^{226}Ra intake, but the recommendations of ICRP indicate that they are not negligible.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 13068, 13069, 13070, 13071

13096 **(DPST—82-969) Occurrence of American shad eggs in 1G cooling-water canal.** McFarlane, R.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Aug 1982. Contract AC09-76SR00001. 11p. NTIS, PC A02/MF A01. Order Number DE83004926.

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American shad eggs are only semi-bouyant and require river turbulence to remain suspended in the water column long enough (three days) for the larvae to hatch. In 1978, shad eggs entrained into the Savannah River Plant 16 cooling-water canal sank to the bottom of the canal before reaching the pumphouse. Eggs removed from the water column in this manner due to decreasing water velocity and turbulence would most likely be lost to predation and burial in the bottom sediments. Efforts to determine egg densities in the river and intake canals were unsuccessful due to the persistent bloom of a slime fungus (Leptomitus sp.) which clogged the plankton sampling apparatus. Thus quantitative estimates of shad egg losses were not obtainable. Further qualitative data would not have been cost-effective so the observations were terminated.

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

REFER ALSO TO CITATION(S) 11594

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 11689, 12466, 12469, 12509, 13025

13097 **(EUR—8188/1-EN) SAMSS: computer-aid system for the preparation of social-science models. Reference and implementation instruction manual. Final report.** Brunet, C.; Dumarchez, P.; Gonzalez, P. (Grenoble-1 Univ., 38 (France)). 1982. 144p. Commission of the European Communities, 2100 M. Street, NW, Washington, DC 20037.

This manual is intended as a tool that will provide the necessary understanding of SAMSS software for its practical use. A brief description of the software, illustrating its general structure is given in the first part. The second part details a step analysis of the software's functions. Finally, the third part is devoted to a SAMSS session, illustrating the actual practical application of the software.

13098 **(EUR—8188/2-EN) SAMSS: computer-aid system for the preparation of social-science models. Final report.** Dumarchez, P. (Grenoble-1 Univ., 38 (France)). 1982. 90p. Commission of the European Communities, 2100 M Street, NW, Washington, DC 20037.

This manual contains detailed functional diagrams and explanations in plain language, but it also contains detailed descriptions in pseudo-algorithmic language for software maintenance personnel. The first part dwells on the technical aspects of SAMSS while the second part deals with the architecture of the software and the techniques it uses, giving the details of what each function does, its input and output, etc. The third part details descriptions in pseudo-

algorithmic language of each of the software modules. Finally, the last part deals with the characteristics of the SAMSS software files.

13099 **(UCRL—88481) Leadership opportunities in the new age.** Kahn, J.S. (Lawrence Livermore National Lab., CA (USA)). Dec 1982. Contract W-7405-ENG-48. 9p. (CONF-8210109—1). NTIS, PC A02/MF A01. Order Number DE83004304.

From Regional opportunities for research and development conference; Vancouver, Canada (17 Oct 1982).

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Leadership opportunities in the new age and the challenges management faces today as it comtemplates the selection of our leaders of tomorrow are discussed. The key to defining leadership opportunities of the future resides in the changing elements of the world of the 1980's. Our neighbors are changing; the tools we use in our work are changing; organizational stress fields are changing; the demogtraphy of the work force is changing; and societal attitudes are changing. As these key elements interact, the organization will be forced to respond in order to remain viable. The organization itself will be challenged by these key elements - challenged about the business it does. These multidimensional interactions are the forces that will define the environment in which we work - political, economic, and social. Recognition of this dynamic set of interactions will assist in defining the profile of the leaders of tomorrow and therefore in prescribing their training.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 11819

13100 **(BNL—32275) Comparing the health and environmental hazards of different energy systems.** Hamilton, L.D. (National Center for Analysis of Energy Systems, Upton, NY (USA); Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 58p. (CONF-820914—5). NTIS, PC A04/MF A01. Order Number DE83004591.

From International conference on nuclear power experience; Vienna, Austria (13 Sep 1982).

Portions of document are illegible.

Energy and environment can pose difficult challenges for policy makers and scientists. Assessing health impacts of different energy sources requires synthesis of research results from many different disciplines into a rational framework. Information is often scanty; qualitatively different risks, or energy systems with quite different end uses, must be put on a common footing. Risk-assessment methods reviewed include examples drawn from work of the Biomedical and Environmental Assessment Division at Brookhaven National Laboratory and elsewhere. Coal and nuclear fuel cycles are compared in respect to morbidity and mortality. Other cycles (oil, gas and renewables) are also examined. In broadening comparisons to include new technologies, one must include the impact of manufacturing the energy-producing devices as part of an expanded fuel cycle, via input-output methods. Input-output analysis allows comparisons of direct and system-wide impacts. Throughout the analysis, uncertainties must be explicitly recognized in the results, including uncertainty in validity of data and uncertainty in choice of appropriate models. No single method of comparative risk assessment is fully satisfactory; each has its limitations. By use of several methods progress has been made in understanding the relative impact of energy technologies.

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 12270

13101 **(NP—3901074) Resumption of exploratory drilling operations by Texaco, Inc.: state oil and gas lesses - PRC 2725.1 (Jade Prospect), PRC 2206.1 (Anita Prospect), PRC 2955.1 (Refugio Prospect), Santa Barbara County. Final environmental impact report.** (California State Lands Commission, Sacramento (USA)). Apr 1982. 484p. NTIS, PC A21/MF A01. Order Number DE83901074.

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An update is presented on air quality conditions in Santa Barbara County, Califorina. Data on photochemical oxidants (measured as ozone), nitrogen dioxide, sulfide dioxide, carbon monoxide, and total suspended particulates are included. Also included are the comments received during the public review and during the public hearing on the Draft Environmental Impact Report on Texaco, Inc.'s proposed Resumption of Exploratory Drilling Operations, State Oil and Gas Leases PRC 2725.1, PRC 2206.1 and PRC 2955.1, responses to these written and oral (hearing) comments, and a modification to the Draft EIR Air Quality Setting section, incorporating updated ambient air quality data. This volume, when added to the Draft Environmental Impact Report, constitutes the Final Environmental Impact Report in accordance with the California Environmental Quality Act (CEQA) and the State Lands Commission's regulations implementing CEQA.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

13102 **(CONF-821218—1) Introduction to modeling fish migratory behavior.** DeAngelis, D.L.; Yeh, G.T. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 49p. NTIS, PC A03/MF A01. Order Number DE83004651.

From Workshop on mechanisms of migration in fishes; Acquafredda di Maratea, Italy (13 Dec 1982).

A few of the basic modeling techniques appropriate to fish migration are reviewed. The biased lattice random walk model and the advection-diffusion model are discussed and illustrated in some depth because these seem to be both practical to use and capable of at least partially imitating the great complexity of real environments. It appears, from our comparisons of these two types of models, that advection-diffusion models may suffer numerical dispersion problems unless care is taken in choosing small enough sizes for the spatial compartments. This problem with advection-diffuison models, plus the greater conceptual simplicity of biased random walk models, may make the latter more attractive to most modelers of migration.

5502 Biochemistry

REFER ALSO TO CITATION(S) 12812, 13059, 13121, 13123, 13124, 13125, 13182, 13189, 13193

13103 **(DOE/EV/72002—58) Nature and mechanism of induction of mutations. Annual progress report, October 1, 1981-August 1, 1982.** Nilan, R.A.; Kleinhofs, A.; Konzak, C.F. (Washington State Univ., Pullman (USA)). 1 Aug 1982. Contract AT06-76EV72002. 25p. NTIS, PC A02/MF A01. Order Number DE83004911.

The major and most significant accomplishment during the past contract year was the chemical identification of the azide metabolite. This accomplishment is unique in plant and bacterial mutagenesis. This is the first observation of a mutagenic amino acid analog. Experiments using barley and bacterial O-acetylserine sulfhydrylase resulted in production of the azide metabolite in vitro. Progress towards understanding the nature of azide-induced mutations continues to be made. In barley (Hordeum vulgare L., cv. Himalaya), DNA-protein crosslinks were detected after azide treatment.

13104 **(INIS-mf—7218) National biochemistry days. Abstracts of papers.** (Ceskoslovenska Akademie Ved, Prague. Ceskoslovenska Spolecnost Biochemicka; Slovenska Akademia Vied, Martin (Czechoslovakia). Slovenska Biochemicka Spolocnost). 1980. 18p. (In Czech). (CONF-8009294—Absts.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83780218.

From National biochemical days conference; Piestany, Czechoslovakia (16 Sep 1980).

Selected papers are indexed separately.

13105 **Neutron scattering studies and modeling of high mobility group 14 core nucleosome complex.** Uberbacher, E.C. (Univ. of Tennessee, Oak Ridge); Mardian, J.K.; Rossi, R.M.; Olins, D.E.; Bunick, G.J. *Proceedings of the National Academy of Sciences of the United States of America;* 79: No. 17, 5258-5262(Sep 1982).

Considerable evidence relates the nonhistone proteins high mobility group (HMG) 14 and HMG 17 with the structure of active or potentially active chromatin. In this study, bulk nucleosome core particles prepared from chicken erythrocytes and the complex formed by binding two HMG 14 molecules per nucleosome core were studied by use of small-angle neutron scattering techniques. By varying the $H_2O/^2H_2O$ ratio, and hence the contrast between the solvent and the particles, it was possible to determine the radius of gyration of the protein and of the DNA independently and as a function of HMG 14 binding. The results show an increase of 0.9 +/- 0.6 angstrom (mean +/- SEM) in the protein radius of gyration and of 2.7 +/- 0.6 angstrom in the DNA radius of gyration upon binding of HMG 14 to the nucleosome. These changes are considered in the light of several postulated modes for the unfolding or perturbation of the nucleosome structure. Modeling calculations demonstrate that the observed changes in radius of gyration for the DNA and for the protein are too small to be consistent with an overall unfolding or opening of the core particle upon HMG 14 binding. However, the observed changes are consistent with several models that involve only minor changes in the structure. It is postulated that the differences observed may be an indication of the type of conformational changes occurring in active nucleosomes.

13106 **Three mutations in Zea mays affecting zein accumulation: a comparison of zein polypeptides, in vitro synthesis and processing, mRNA levels, and genomic organization.** Burr, F.A.; Burr, B. (Brookhaven National Lab., Upton, NY). *Journal of Cell Biology;* 94: 201-206(Jul 1982).

Researchers studied three mutations, opaque-2 (o2), opaque-7 (o7), and floury-2(fl2), each of which causes a depression in zein synthesis. Researchers examined the processing efficiencies of the rough endoplasmic reticulum membranes in vitro, the levels of RNA transcription using cloned zein probes, and the genomic organization of the zein sequences as possible sites for the genetic defects. The results obtained indicate that the steps in prezein translation and processing occurring on the protein body membranes are not accountable for the lowered zein content in any ofl the mutations. The o2 mutation that typically shows a paucity of 22.5-kdalton zein polypeptides was found to have a concomitant reduction in a particular subgroup of mRNAs coding for this size class. Southern analyses suggest that the 02 mutation is not the result of a large deletion of tandem-linked zein genes.

13107 **Cells of pea (Pisum sativum) that differentiate from G2 phase have extrachromosomal DNA.** Van't Hof, J.; Bjerknes, C.A. (Brookhaven National Lab., Upton, NY). *Molecular and Cellular Biology;* 2: No. 4, 339-345(Apr 1982).

Velocity sedimentation in an alkaline sucrose gradient of newly replicated chromosomal DNA revealed the presence of extrachromosomal DNA that was not replicated by differentiating cells in the elongation zone. The extrachromosomal DNA had a number average molecular weight of 12×10^6 to 15×10^6 and a weight average molecular weight of 25×10^6, corresponding to about 26×10^6 and 50×10^6 daltons, respectively, of double-stranded DNA. The molecules were stable, lasting at least 72 h after being formed. Concurrent measurements by velocity sedimentation, autoradiography, and cytophotometry of isolated nuclei indicated that the extrachromosomal molecules were associated with root-tip cells that stopped dividing and differentiated from G2 phase but not with those that stopped dividing and differentiated from G1 phase.

13108 **Membrane-associated precursor to poliovirus VPg identified by immunoprecipitation with antibodies directed against a synthetic heptapeptide.** Semelr, B.L. (State Univ. of New York, Stony Brook); Anderson, C.W.; Hanecak, R.; Dorner, L.F.; Wimmer, E. *Cell;* 28: 405-412(Feb 1982).

A synthetic heptapeptide corresponding to the C-terminal sequence of the poliovirus genome protein (VPg) has been linked to bovine serum albumin and used to raise antibodies in rabbits. These antibodies precipitate not only VPg but also at least two more virus-specific polypeptides. The smaller polypeptide, denoted P3-9 (12,000 daltons), has been mapped by Edman degradation and by fragmentation with cyanogen bromide and determined to be the N-terminal cleavage product of polypeptide P3-1b, a precursor to the RNA polymerase. P3-9 contains the sequence of the basic protein VPg (22 amino acids) at its C terminus. As predicted by the known RNA sequence of poliovirus, P3-9 also contains a hydrophobic region of 22 amino acids preceding VPg, an observation suggesting that P3-9 may be membrane-associated. This was confirmed by fractionation of infected cells in the presence or absence of detergent. We speculate that P3-9 may be the donor of VPg to RNA chains in the membrane-bound RNA replication complex.

13109 **Aggregation of low density lipoproteins with unilamellar phosphatidylcholine vesicles.** Hunter, J.A.; Shahrokh, Z.; Forte, T.M.; Nichols, A.V. (Lawrence Berkeley Lab., CA). *Biochemical and Biophysical Research Communications;* 105: No. 3, 828-834(1982).

Incubation of human plasma LDL with phosphatidylcholine vesicles produced turbidity in the mixture. Gradient gel electrophoresis showed a linear decrease of LDL with increasing levels of vesicles. Concomitantly, increasing amounts of material with dimensions greater than 50 nm appeared at the top of the gel. When isolated by velocity ultracentrifugation, the turbid product had a cholesterol:protein weight ratio similar to native LDL but a phospholipid:protein ratio over three-fold greater. Electron microscopy showed that this material consisted of closely associated particles with dimensions similar to those of starting LDL and vesicles. These data demonstrate aggregation of LDL and vesicles upon incubation without a significant change in their particle size. Prevention of aggregate formation by pretreatment of LDL with trypsin indicates the involvement of apolipoprotein B in this process.

13110 **Energy transfer in self-assembled chlorophyll a systems.** Yuen, M.J.; Shipman, L.L.; Katz, J.J.; Hindman, J.C. (Argonne National Lab., IL). *Photochemistry and Photobiology;* 36: 211-222(1982).

Computer deconvolution of the optical absorption spectra has been used to follow the formation and transformation of various chlorophyll species formed by lowering the temperature in solutions of toluene or methylcyclohexane containing a hydrogen-bonding nucleophile such as ethanol. At cryogenic temperatures the self-assembled chlorophyll a-ethanol species has optical properties similar to those of special pair photoreaction center chlorophyll. Analysis of the absorption and fluorescence behavior of the self-assembled species suggests that chlorophyll-chlorophyll species are also formed in the self-assembly process. Fluorescence lifetime measurements indicate that the pathways for dissipation of excitation energy in these multicomponent systems are complex. Selective optical excitation at wavelengths corresponding to absorption of monomer, oligomer, etc. chlorophyll a species has been used to demonstrate the heterogeneous nature of these self-assembled systems.

13111 **Inducible cadmium binding complexes of cabbage and tobacco.** Wagner, G.J.; Trotter, M.M. (Brookhaven National Lab., Upton, NY). *Plant Physiology;* 69: 804-809(1982).

Cadmium complexes with apparent molecular weights of 10,000 were observed in aqueous extracts of Cd-treated cabbage (Brassica capitata L., cv. red danish) and tobacco (hybrid of Nicotiana glauca and N. langsdorffii) plants. The amount of complex (as Cd) recovered was found to be dependent on the concentration of the metal in the growth medium and the total time of exposure of plants to the metal. Induction of the complex at moderate levels of ^{113}Cd exposure was monitored after labeling the complex with ^{109}Cd in vitro. The constitutive nature of the ligand of the complex in cabbage and tobacco leaves was suggested when control plant extracts were exposed to ^{109}Cd. Such extracts contained ^{109}Cd, which eluted froom Sephadex G-50 in the region of Cd complex. Simultaneous labeling with ^{113}Cd and ^{35}S or ^{32}P indicated that the complex contained sulfur but probably not phosphorus. The amount of ^{35}S which eluted coincident with ^{113}Cd complex increased during complex induction. No evidence was found for the presence of 10,000 molecular weight Cd complex in stem exudates

(vascular sap) of Cd-treated plants. The results obtained are consistent with the presence in these tissues of a ligand which is both inducible and consitutive and binds Cd in mercaptide bonds. All of these properties and oters reported earlier, are characteristic of Cd-metallothionein formed in animals.

13112 **Histochemistry of NADH diaphorase and γ-glutamyltranspeptidase in rat bladder tumors.** Vanderlaan, M. (Lawrence Livermore National Lab., CA); Fong, S.; King, E.B. *Carcinogenesis (New York);* 3: No. 4, 397-402(1982). Contract W-7405-ENG-48.

To improve identification of preneoplastic bladder cancer cells, we have studied two enzyme histochemical changes in bladder tumors induced in male Fisher 344 rats by the carcinogen N-butyl-N-(4-hydroxybutyl)-nitrosamine. In early areas of focal nodular hyperplasia there was a dramatic increase in staining for NADH:menadione oxidoreductase (diaphorase) activity. In nonfocal areas as well, there were many individual cells with intense staining, while the controls were of uniform moderate staining. Large papillomas and carcinomas often showed heterogeneous staining, γ-Glutamyltranspeptidase (GGT) was absent from normal urothelium and from all tumors except the most advanced carcinomas and large papillomas. In old, carcinogen-exposed animals, GGT activity was seen in the luminal surface of tumors and in the interlesion urothelium. In newborn rats and in rats with regenerative hyperplasia following wounding of the urothelium, the diaphorase staining was less than that in the untreated adult. Our findings suggest that increased diaphorase activity may serve to identify early islands of carcinogen-induced, enzymatically altered bladder cells, while GGT will not.

13113 **Protease inhibitors neither damage DNA nor interfere with DNA repair or replication in human cells.** Borek, C. (Columbia Univ., New York); Cleaver, J.E. *Mutation Research;* 82: 373-380(1981).

Human fibroblasts were exposed to antipain or leupeptin at concentrations up to 2.5 mM and the presence of DNA damage and repair was assayed by several different methods. These did not reveal DNA damage or repair after exposure to either antipain or leupeptin, even in the presence of rat-liver microsomal S9 mix. Antipain also had no significant effects on the repair or replication of DNA after ultraviolet or x-irradiation. The demonstrated potentiation of radiation-induced transformation of human cells and the selective killing of repair-deficient cells by antipain must therefore occur by mechanisms that do not involve direct interaction of antipain with DNA.

13114 **Alternative view of mammalian DNA sequence organization. I. Repetitive sequence interspersion in Syrian hamster DNA: a model system.** Moyzis, R.K.; Bonnet, J.; Li, D.W.; Ts'o, P.O.P. (Johns Hopkins Univ., Baltimore, MD). *Journal of Molecular Biology;* 153: 841-870(1981). Contract AC02-76EV03280.

The biochemical and biophysical techniques originally introduced by Davidson et al. (1973) and Graham et al. (1974) for the determination of the general organization and length of repetitive and non-repetitive sequences in eukaryotic DNA have been extended and modified. Improvements in the experimental methods employed in these pioneering works have led to novel interpretations and conclusions about mammalian DNA sequence organization. In what is commonly referred to as an interspersion experiment, the average spacing of repetitive DNA regions is inferred from the length dependence of hydroxyapatite binding of radio-labeled tracer DNAs reassociated with an excess of short 200 nucleotide repetitive sequence driver DNA. Studies on Syrian hamster DNA, using an improved procedure for conducting interspersion experiments, suggest that either a frequent cluster in the distribution of non-repetitive DNA sequence lengths occurs at 7200 (+- 2000) nucleotides or that repetitive sequences are randomly spaced on a number average basis. In contrast, measurements obtained using the traditional methods suggest that a frequent cluster in the distribution of non-repetitive DNA sequence lengths occurs at approximately 1000 nucleotides. When reassociations were conducted at elevated temperatures, to allow only well-matched repetitive sequences to hybridize, the amount of DNA operationally observed as repetitive was reduced. Interspersion experiments conducted with Syrian hamster DNA at a reassociation temperature of 75°C yielded data similar to those obtained by Manning et al. (1975) for Drosophila melanogaster DNA reassociated at 60°C.

13115 **Alternative view of mammalian DNA sequence organization. II. Short repetitive sequences are organized into scrambled tandem clusters in Syrian hamster DNA.** Moyzis, R.K.; Bonnet, J.; Li, D.W.; Ts'P, P.O. (Johns Hopkins Univ., Baltimore, MD). *Journal of Molecular Biology;* 153: 871-896(1981). Contract AC02-76EV03280.

Re-evaluation of the hyperchromicity techniques commonly used to determine the average length of genomic repetitive DNA regions indicates that both the extent of reassociation, and the possibility of non-random elution of hyperpolymers from hydroxyapatite can radically affect the observed hyperchromicity. An alternative interpretation of hyperchromicity experiments, presented here, suggests that the average length of repetitive regions in Syrian hamster DNA must be greater than 4000 nucleotides. S_1 nuclease digestion of reassociated 3200 nucleotide Syrian hamster repetitive DNA, on the other hand, yields both long (> 2000 nucleotides) and short (300 nucleotides) resistant DNA duplexes. Calculations indicate that the observed mass of short nuclease-resistant duplexes (> 60%) is too large to have arisen only from independent short repetitive DNA sequences alternating with non-repetitive regions. Reassociation experiments using long and short S_1 nuclease-resistant duplexes as driver DNA indicate that all repetitive sequences are present in both fractions at approximately the same concentration. Isolated long S_1 nuclease-resistant duplexes, after denaturation, renaturation, and a second S_1 nuclease digestion, again produce both long and short DNA duplexes. Reassociation experiments indicate that all repetitive DNA sequences are still present in the recycled long S_1 nuclease-resistant duplexes. These experiments imply that many of the short S_1 nuclease-resistant repetitive DNA duplex regions present in reassociated Syrian hamster DNA were initially present in the genome as part of longer repetitive sequence blocks. This conclusion suggests that the majority of short repetitive regions in Syrian hamster DNA are organized into scrambled tandem clusters rather than being individually interspersed with non-repetitive regions.

13116 **Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture.** Jones, P.A. (Univ. of Southern California, Los Angeles); Werb, Z. *Journal of Experimental Medicine;* 152: 1527-1536(Dec 1980). Contract AC03-76SF01012.

Thioglycollate-elicited mouse peritoneal macrophages were cultured in contact with the mixture of extracellular matrix proteins produced by rat smooth muscle cells in culture. Both live macrophages and their conditioned media hydrolyzed glycoproteins, elastin, and collagen. Live macrophages also degraded extracellular connective tissue proteins secreted by endothelial cells and fibroblasts. The glycoproteins in the matrix markedly inhibited the rate of digestion of the other macromolecules, particularly elastin. When plasminogen was added to the matrix, activation of plasminogen to plasmin resulted in the hydrolysis of the glycoprotein components, which then allowed the macrophage elastase easier access to its substrate, elastin. Thus, although plasmin has no direct elastinolytic activity, its presence accelerated the rate of hydrolysis of elastin and therefore the rate of matrix degradation. These findings may be important in an understanding of disease states, such as emphysema and atherosclerosis, that are characterized by the destruction of connective tissue.

5503 Cytology

REFER ALSO TO CITATION(S) 13116, 13137, 13181, 13192

13117 **(BNL—32174) Automated flow microfluorometer and cell sorter incorporating nuclear electronics.** Stubblefield, F.W. (Brookhaven National Lab., Upton, NY (USA)). Oct 1982. Contract AC02-76CH00016. 7p. (CONF-821011—38). NTIS, PC A02/MF A01. Order Number DE83004630.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

A computer-automated flow microfluorometer and cell sorter are under development for the Medical Department of Brookhaven National Laboratory. The device will be capable of analyzing and sorting samples of biological cells based on measurements of laser-induced fluorescence and cell volume. The system incorporates the laser optics and droplet generation mechanics of a standard Becton-Dickinson FACS II cell sorter. The capabilities of the FACS II device are being upgraded, chiefly in the areas of data display and recording and, to a lesser extent, on-line data analysis.

13118 **(DOE/EV/10270—3) Marrow-tumor interactions: the role of the bone marrow in controlling chemically induced tumors. Annual progress report, August 1, 1981-July 31, 1982.** Rosse, C. (Washington Univ., Seattle (USA). School of Medicine). 1982. Contract AT06-79EV10270. 17p. NTIS, PC A02/MF A01. Order Number DE83004870.

Research progress is reported for studies aimed at: (1) establishing an in vitro system for defining the cellular mechanisms that result in tumor neutralization through the cooperation of tumor immune T cells and bone marrow-derived Natural Growth Regulatory CellS (NTRC); (2) defining the stem cell populations on which CE mouse mammary carcinoma exerts a bodulating influence; and (3) identifying bone marrow-derived and bone marrow-dependent cell populations with a potential for participating in antitumor responses. (ACR)

13119 **Lumen formation by epithelial cell lines in response to collagen overlay: a morphogenetic model in culture.** Hall, H.G.; Farson, D.A.; Bissel, M.J. (Lawrence Berkeley Lab., CA). *Proceedings of the National Academy of Sciences of the United States of America;* **79**: No. 15, 4672-4676(Aug 1982). Contract AC03-76SF00098.

Two cells lines--Madin-Darby canine kidney (MDCK) and normal murine mammary gland (NMuMG)--growing as monolayers on collagen gels were overlaid with another collagen gel. The cells responded to the overlay by undergoing reorganization resulting in the creation of lumina. MDCK cells formed lumina that coalesced to form large cavities comparable in size with a tubule. NMuMG cells formed clusters surrounding small lumina, which appeared similar to acini of glandular tissue. The characteristic arrangements, described here by light and electron microscopy, resembled the morphology of the tissues of cell line origin. MDCK cells, grown in the presence of serum, formed lumina whether or not serum was removed at the time of overlay, whereas NMuMG cells required either a nondialyzable component of serum or hormonal supplements in serum-free defined media. Lumen formation was delayed by MDCK cells in the presence of the glutamine analog 6-diazo-5-oxo-L-norleucine, but this compound did not affect NMuMG lumen formation. In both cell lines, lumen formation was unaffected by the absence of sulfate, the presence of an inhibitor of sulfate glycosaminoglycan synthesis, or an inhibitor of collagen synthesis. DNA synthesis accompanied lumen formation but was not required.

13120 **Regulation of the colony-stimulating activity produced by a murine marrow-derived cell line (H-1).** Garnett, H.M. (Brookhaven National Lab., Upton, NY); Cronkite, E.P.; Harigaya, K. *Proceedings of the National Academy of Sciences of the United States of America;* **79**: 1545-1548(Mar 1982). Contract AC02-76CH00016.

The production of molecular species that stimulate growth of granulocyte or macrophage colonies (GM-CSF) by the fibroblastoid H-1 cell line is unaffected by either native or iron-saturated lactoferrin, although some inhibition is detected with 10 μM prostaglandin E_1. The H-1 GM-CSF is able to support the formation of macrophage, neutrophil, and mixed colonies. This inhibitory effect is observed irrespective of the presence of an additional agar layer between the feeder cells and plated bone marrow cells, implying that diffusable substances are involved. Addition of indomethacin (10 μM) to feeder layers derived from 2.5×10^3 H-1 cells increases the number of GM-CFU/sub c/ detected to 50% of that seen with conditioned medium alone. This result suggests that released prostaglandin may be responsible for some, but not all, of the observed inhibition of colony formation. In the presence of the H-1 feeder layers, only macrophage colonies are detected and hence it appears that the H-1 cells produce, in addition to prostaglandin, a diffusible inhibitory substance that preferentially inhibits granulopoiesis.

13121 **Control of proton efflux from corn root tissue by an injury-sensing mechanism.** Chastain, C.J.; Hanson, J.B. (Univ. of Illinois, Urbana). *Plant Science Letters;* **24**: 97-104(1982). Contract AC02-76EV00790.

The electrogenic H^+ efflux of washed corn root tissue is completely inhibited by brief exposure to ice temperatures, hypertonicity and gentle rubbing. Fusicoccin (FC) will partially restore the H^+ pumping, and an uncoupler will nullify the effect of FC. Oligomycin and ethidium bromide, known to block H^+ transport by mitochondrial ATPase, will very rapidly block H^+ efflux from roots and FC will partially restore it. The previously reported inhibition of H^+ efflux by protein synthesis inhibitors occurs before amino acid incorporation is much affected. Use of the pH indicator dye, bromocresol purple, shows that cutting injury leads to H^+ influx in cells around the wound surface; cold shock leads to a general H^+ influx. It is proposed that external and internal injuries signal activation of an endogenous control mechanism which blocks the H^+ channel of the plasmalemma ATPase and that FC acts to bypass the block.

13122 **Amino acid synthesis in photosynthesizing spinach cells: effects of ammonia on pool sizes and rates of labeling from $^{14}CO_2$.** Larsen, P.O.; Cornwell, K.L.; Gee, S.L.; Bassham, J.A. (Univ. of California, Berkeley). *Plant Physiology;* **68**: 292-299(1981). Contract W-7405-ENG-48.

Isolated cells from leaves of Spinacia oleracea have been maintained in a state capable of high rates of photosynthetic CO_2 fixation for more than 60 hours. The incorporation of $^{14}CO_2$ under saturating CO_2 conditions into carbohydrates, carboxylic acids, and amino acids, and the effect of ammonia on this incorporation have been studied. Total incorporation, specific radioactivity, and pool size have been determined as a function of time for most of the protein amino acids and for γ-aminobutyric acid. The measurements of specific radio-activities and of the approaches to ^{14}C saturation of some amino acids indicate the presence and relative sizes of metabolically active and passive pools of these amino acids. Added ammonia decreased carbon fixation into carbohydrates and increased fixation into carboxylic acids and amino acids. The results indicate that added ammonia stimulates the reactions mediated by pyruvate kinase and phosphenoenolpyruvate carboxylase, as seen with other plant systems. The data on the effects of added ammonia on total labeling, pool sizes, and specific radioactivities of several amino acids provides a number of indications about the intracellular sites of principal synthesis from carbon skeletons of these amino acids and the selective nature of effects of increased intracellular ammonia concentration on-such synthesis.

13123 **Degradation of connective tissue matrices by macrophages. III. Morphological and biochemical studies on extracellular, pericellular, and intracellular events in matrix proteolysis by macrophages in culture.** Werb, Z. (Univ. of California, San Francisco); Bainton, D.F.; Jones, P.A. *Journal of Experimental Medicine;* **152**: 1537-1553(Dec 1980). Contract AC03-76SF01012.

The aim of the present study was to determine the localization of macrophage-mediated degradation of matrix proteins. The sites of matrix degradation were examined ultrastructurally, and the effects of modulation of macrophage secretion, endocytosis, and activity of macrophage hydrolases on matrix degradation were monitored biochemically.

5504 Genetics

REFER ALSO TO CITATION(S) 13106, 13174

13124 **Ds controlling elements of maize at the shrunken locus are large and dissimilar insertions.** Burr, B.; Burr, F.A. (Brookhaven National Lab., Upton, NY). *Cell;* **29**: 977-986(Jul 1982).

A recombinant clone for the wild-type gene of sucrose synthetase has been selected. Subclones of the genomic clone were made and used as probes to construct a restriction map of the wild-type locus. the transcribed region and the direction of transcription in the map were also determined. Four Ds-induced mutations of the

locus that were isolated by B. McClintock were analyzed and partially mapped. Two mutations contain insertions of approx. 20 kb of foreign DNA into the transcribed region; two others are at the 5' end of the gene. There are profound differences in the restriction maps of the Ds elements in the mutants analyzed, even though these elements have a common genetic origin and are separated by only a few generations. Comparison of one pair of closely related Ds elements indicates that these differences may be the result of extensive internal rearrangements. Exchange with other elements in the genome remains an alternative possibility. A revertant of one of the Ds-induced mutations has maintained a 21 to 22 kb insert at the same location in the transcribed region. This insert differs from its predecessor by extensive rearrangement in two thirds of its length. Part, or all, of this rearrangement presumably permits functional expression of the gene.

13125 **Detection of changes in maize DNA at the shrunken locus due to the intervention of Ds elements.** Burr, B.; Burr, F.A. (Brookhaven National Lab., Upton, NY). *Cold Spring Harbor Symposia on Quantitative Biology;* **45**: 463-465(1981).

This report describes our initial attempts at the molecular characterization of a controlling element in maize. A cDNA probe has been prepared to detect changes at a locus where Ds (Dissociation) elements are found. Evidence of their presence is indicated by changes in the restriction patterns, but there is as yet no information on the physical nature of the controlling elements or on the kinds of rearrangements they cause. It should be remembered that at the 1951 Cold Spring Harbor Symposium, McClintock (1952a) provided extensive evidence for the physical presence of controlling elements.

5505 Metabolism

REFER ALSO TO CITATION(S) 13122, 13135

13126 **(DOE/ER/12028—1) Proline metabolism in plants under environmental stresses. Progress report, April 1, 1982-December 31, 1982.** Stewart, C.R.; Elthon, T.E. (Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Botany). Dec 1982. Contract AC02-82ER12028. 27p. NTIS, PC A03/MF A01. Order Number DE83002735.

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This report summarizes progress toward understanding the basic mechanisms involved in proline accumulation by plants under environmental stresses. This accumulation is thought to be part of the process of osmoregulation - an adaptive phenomenon that occurs in plants and other organisms to aid survival in arid and saline environments. This understanding will aid in developing cultural strategies for producing food and biomass in marginal lands and environments. We have shown that proline transport into the mitochondrial matrix is protonmotive, thus energy dependent but not driven by an electrical gradient. Transport rates exceed oxidation rates under non-phosphorylating conditions. We have been able to study the nature of specific inhibition of proline oxidation using an artificial inhibitor, thiazolidine-4-carboxylate. This compound mimics the effects of stress on proline oxidation. Attempts have been made to obtain cell-free proline synthesis in pursuit of the enzyme, gamma-glutamokinase which is probably the enzyme most affected by stress. We have not been successful using conventional enzyme extraction procedures. We will continue this work using isolated cells and perhaps protoplasts. We have determined the metabolic mechanism which causes proline to accumulate in salt stressed leaves. The results are qualitatively similar to those obtained in drought- and ABA-induced leaves with minor quantitative differences. A preliminary draft of a manuscript is included.

13127 **(EUR—7680-EN) Investigation of electron-transport mechanisms in photosynthesis. Final report.** Joliot, P.; Diner, B.A.; Wollman, F.A. (Paris-6 Univ., 75 (France). Inst. de Biologie Physico-Chimique). 1982. 49p. European Community Information Service, 2100 M Street NW, Suite 707, Washington, DC 20037.

Studies on the biochemical nature and the structural organization of the active component of the photosynthetic apparatus are reported. Research efforts have been concentrated in two areas: (1) energy transfer in the pigment, and (2) the conversion of excitation energy to chemical energy within the photocenters and the charge stabilization process which immediately follows it. (ACR)

13128 **Charge separation in the light reactions of photosynthesis.** Sauer, K. (Univ. of California, Berkeley). pp 685-699 of Photosynthesis III. Structure and molecular organisation of the photosynthetic apparatus. Akoyunoglou, G. (ed.). Philadelphia, PA; Balaban International Science Services (1981). Contract W-7405-ENG-48.

The initial events of the photosynthetic light reactions are described in terms of light absorption, excitation transfer, trapping, and electron transfer by radical-pair charge separation.

5506 Medicine

REFER ALSO TO CITATION(S) 11945, 13059, 13112, 13136

13129 **(BNL—32297) Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET.** Lambrecht, R.M.; Duncan, C.C.; Shiue, C.Y. (Brookhaven National Lab., Upton, NY (USA); Yale Univ., New Haven, CT (USA). School of Medicine). 1982. Contract AC02-76CH00016. 5p. (CONF-820804—3). NTIS, PC A02/MF A01. Order Number DE83004582.

From 3. world congress of nuclear medicine and biology; Paris, France (29 Aug 1982).

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The tracer kinetics of 4-Fluoro(^{18}F)-, 4-Bromo(^{82}Br)- and 4-Iodo(^{123}I)-antipyrine and ^{15}O-water were compared in a cat or baboon animal model. First-pass cerebral extraction and clearance with alterations in $PaCO_2$ were measured for whole brain. The Renkin/Crone model was used to evaluate brain capillary permeability-surface area product for 4-^{18}FAP in cats. Positron-emission-tomographic measurements required development of an instrument and technique for control of the arterial concentration of the radiotracer as a ramp function, so that tracer concentration changes due to radioactive decay or altered physiological processes could be accurately described with PET. Pharmacokinetic and tissue-distribution studies in cats were used to determine dosimetry for 4-^{18}FAP. 4-Bromoantipyrine labeled with ^{75}Br (t = 6.5 m) is suggested as a tracer for determination of rCBF with PET.

13130 **(DOE/EV/04024—T1) Exposure of pharmacy personnel to mutagenic antineoplastic drugs.** Nguyen, T.V.; Theiss, J.C.; Matney, T.S. (Texas Univ., Houston (USA). Health Science Center). 1981. Contract AS05-76EV04024. 21p. NTIS, PC A02/MF A01. Order Number DE83003400.

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The Salmonella reversion test was used to measure the mutagenic activities of urine concentrates from individuals preparing cancer chemotherapy agents for intravenous administration. Longitudinal studies were performed in which the total urine produced in 24 hour periods was collected, starting on a Sunday at 7:00 p.m. after a duty-free weekend and extending over an eight day period. There was no detectable increase in mutagenic activity in the urine concentrates of three pharmacy administrators who had no contact with these drugs. All six individuals admixing drugs in open-faced, horizontal laminar flow hoods displayed a two-fold increase in mutagenesis by the fourth day with peak values of 2.7 to 24-fold occurring on days five and six, reduced values by day seven with a return to the spontaneous level by day eight. When four of the six positive individuals in the preceding experiment admixed comparable amounts of chemotherapeutic drugs in a closed-faced, vertical laminar flow hood, no increase in mutagenic activity was detected in their urine concentrates over the eight day period.

13131 **(ORNL/TM—8533) Nuclear medicine progress report for quarter ending September 30, 1982.** Knapp, F.F. Jr.; Ambrose, K.R.; Butler, T.A.; Goodman, M.M.; Hoeschele, J.D.; Srivastava, P.C. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE83005170.

In this report a new kit is described for the rapid, regiospecific radioiodination of 15-(p-iodophenyl)pentadecanoic acid (IPP).

Iodine-123-labeled IPP is used clinically to monitor myocardial fatty acid metabolism and the new kit offers a major improvement over present methods of radioiodination. During the period three shipments of ^{191}Os-osmate were made to Medical Cooperative investigators for fabrication of the ^{191}Os-/sup 191m/Ir radionuclide generator. Five production runs of ^{11}C labeled amino acids including L-valine, DL-tryptophan and 1-aminocyclohexanecarboxylic acid were synthesized for clinical studies at the Oak Ridge Associated Universities. In addition, seven shipments of /sup 195m/Pt-cis-dichlorodiammineplatinum(II) were made to collaborators for evaluation of the pharmacologic properties of this antitumor agent and to monitor the effective therapeutic dose levels. Several ^{125}I- and /sup 123m/Te-labeled fatty acids were prepared for evaluation in conjunction with collaborators at the Massachusetts General Hospital. Studies of radioiodinated barbiturates as potential new agents to measure cerebral blood perfusion have also continued. Iodine-125-labeled 5-ethyl-t-(meta-iodophenyl)barbituric acid was prepared as a model agent in which the iodine was stabilized by attachment to a phenyl ring. Evaluation in rats indicated brain uptake with only minimal deiodination. Preliminary studies with tritium-labeled benzo(a)pyrene have also been performed using Syrian hamster embryo (SHE) cells grown in diffusion chambers implanted in rats.

13132 **Measurement of unscheduled synthesis by autoradiography.** Cleaver, J.E.; Thomas, G.H. (Univ. of California, San Francisco). pp 277-287 of DNA repair: a laboratory manual of research procedures. Volume 1. Part B. Friedberg, E.C.; Hanawalt, P.C. (eds.). New York, NY; Marcel Dekker, Inc. (1981).

Rasmussen and Painter observed that whereas [^{3}H]-thymidine (dT) is usually incorporated only into S-phase cells during semiconservative DNA replication, in irradiated cell populations [^{3}H]dT was incorporated into DNA at all stages of the cell cycle. The term unscheduled synthesis was coined to describe this autoradiographically detected step of DNA repair and it has since entered general usage. Unscheduled synthesis is readily detectable in tissue cultures damaged by UV light or by chemical mutagens such as 4-nitroquinoline-1-oxide, N-acetoxyacetylaminofluorene, methylnitrosourea, N-methyl-N′-nitro-N-nitrosoguanidine, and others, but only after high doses of x rays (1 to 10 krads), ethylating alkylating agents, and DNA-DNA cross-linking agents. The precise amount of incorporation depends on the particular mutagen, the kind of excision repair it evokes, the patch sizes involved, and on such obvious factors as the concentration of [^{3}H]dT, the duration of labeling, the ability of cells to use exogenous precursors, and the efficiency of the autoradiographic procedure itself. Autoradiography was one of the original methods by which repair was discovered and remains a dramatic visual method by which repairing cells can be observed.

13133 **Pulmonary function and /sup 81m/Kr scans in obstructive pulmonary disease.** Kaplan, E. (Veterans Administration Hospital, Hines, IL); Mayron, L.W.; Gergans, G.A.; Shponka, S.; Barnes, W.E.; Friedman, A.M.; Gindler, J.E.; Fishman, H.; Sharp, J.T. *International Journal of Nuclear Medicine and Biology;* 8: 39-51(1981).

Pulmonary ventilation in 13 normal subjects and in 18 patients with known chronic obstructive pulmonary disease (COPD) has been characterized with two modalities. Comparison consisted of correlating standard pulmonary function tests (PFT) and scintigraphic images of the lungs under steady state conditions during tidal respiration of krypton-81m. The lung scintigram was evaluated by inspection and a computer generated histogram in which the ratio of low level and high level ventilation of the lung was determined. Pulmonary function tests were the basis for verifying normality in 13 subjects. Scintigraphic imaging and histogram analysis in 18 patients with COPD produced two false negative results by each method. The combined scintigraphic histogram results correctly defined 13 of 13 normal subjects. The two scintigraphic methods differentiated normal subjects from patients with known COPD with a high level of comparability to PFT.

5507 Microbiology

REFER ALSO TO CITATION(S) 11971, 11973, 12042, 12105, 13079, 13108

13134 **(DOE/ER/10697—T1) Regulatory mechanisms in Thielavia terrestris. Final report.** Tuse, D.; Hokama, L. (SRI International, Menlo Park, CA (USA). Biotechnology Research Dept.). 15 Mar 1982. Contract AC03-80ER10697. 37p. NTIS, PC A03/MF A01. Order Number DE83002858.

Thielavia terrestris is a filamentous ascomycete originally discovered and identified as Allescheria terrestris by Apinis (1963). Strain S-16 was isolated from a soil sample in California and found to grow at temperatures as high as 50°C. The fungus produces a complete cellulase system that enables it to degrade native, crystalline cellulose to glucose. The enzymes display high heat and pH stability and an optimum temperature for hydrolysis of 65°C, making it attractive for the eventual commercial conversion of cellulose into fuel and chemicals. We report on the enzyme activity of Thielavia terrestris S-16, the effects of medium composition and carbon source on enzyme production, the growth of the organism at different temperatures, the extracellular aryl-β-glucosidase activity as a function of incubation temperature, the effects of small-molecular-weight metabolic regulators and membrane-active antibiotics on the cell-associated and extracellular enzyme levels, and the methods used in an attempt to find plasmids.

13135 **Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms.** Ljungdahl, L.G.; Bryant, F.; Carreira, L.; Saiki, T.; Wiegel, J. (Univ. of Georgia, Athens). pp 397-419 of Trends in the biology of fermentations for fuels and chemicals. Hollaender, A.; Rabson, R. (eds.). New York, NY; Plenum Publishing Corporation (1981).

In this presentation, the acetogenic thermophilic bacterium, Clostridium thermoaceticum, that ferments glucose almost quantitatively to acetate was discussed. That part of the acetate is formed from CO_2, which functions as the electron sink. It was demonstrated that enzymes in the acetate formation contain trace elements such as iron, cobalt, nickel, selenium and tungsten. Furthermore, this bacterium must have an electron transport system, which is not yet completely understood. With Clostridium thermohydrosulfuricum results were obtained which indicate that this thermophile may selectively produce proteins dependent on the environmental temperature. A new bacterium, Thermoanaerobacter ethanolicus, ferments several sugars including starch, cellobiose, and xylose to ethanol. We have demonstrated the existence in a thermal environment of anaerobic bacteria that grow at temperatures of around 90°C and which are capable of fermenting diverse substrates such as lactate, glucose, and cellulose.

5508 Morphology

13136 **(LA—9539-MS) LENS* 4: a program for calculation of geometric optics of the human eye.** Doss, J.D. (Los Alamos National Lab., NM (USA)). Oct 1982. Contract W-7405-ENG-36. 17p. NTIS (US Sales Only). Order Number DE83003890.

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A computer program (LENS* 4) has been written that may be used for ray-trace calculations of human or animal eyes. The user enters all relevant eye specifications, and the program calculates ray segments from a (specified) external object. From the ray calculations, the program yields data on image location, image distance from the retina, retinal spot size, and effective pupil diameter. The program also allows entry of simple corrective lens systems that simulate a contact lens or ordinary spectacles. Graphics output illustrating the eye cross section, corrective lens, and rays is provided either on the CRT, thermal printer, or graphics plotter. Although the program is written in BASIC, many of the statements (particularly in the graphics section) are peculiar to the Hewlett-Packard 9845B desktop computer.

13137 **Pulmonary alveolar pores and alveolar macrophage-mediated particle clearance.** Ferin, J. (Univ. of Rochester, NY). *Anatomical Record;* **203**: 265-272(1982). Contract AC02-76EV03490.

Pulmonary alveolar macrophages (AM) are considered to have an essential role in alveolar clearance of particles. The AM occupy only a small portion of the alveolar surface and their number is probably lower than the number of alveoli. Even at realistic experimental exposures the number of deposited particles, which are distributed all over the lung surface, is orders of magnitude higher than the number of AM. Phagocytosis of deposited particles, however, is being accomplished rapidly within hours. Based on microscopic evidence, we suggest that alveolar pores serve as important passageways for AM by shortening the distance between particles and AM. Accordingly, the pores of Kohn may, in part, lend efficiency to the in vivo particle collection by AM.

5509 Pathology

REFER ALSO TO CITATION(S) 13138

5510 Physiological Systems

REFER ALSO TO CITATION(S) 13111, 13137

5520 Public Health

REFER ALSO TO CITATION(S) 13187, 13195

13138 **(LBL—14234) Selected epidemiological observations of cell-specific leukemia mortality in the USA, 1969-1977.** Selvin, S.; Levin, L.I.; Merrill, D.W.; Winkelstein, W. Jr. (Lawrence Berkeley Lab., CA (USA)). Mar 1982. Contract AC03-76SF00098. 27p. (CONF-8206140—1). NTIS, PC A03/MF A01. Order Number DE83003986.

From 15. annual meeting of Society for Epidemiological Research; Cincinnati, OH, USA (17 Jun 1982).

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Utilizing a newly available data set which includes for the first time cell-specific leukemia mortality rates for the USA during the period 1969-1977, age and sex distributions, time trends and geographic patterns have been analyzed. Four major cell types of leukemia were considered. Acute lymphatic leukemia had a bimodal distribution with the first peak in the 5 to 9 year age group and lowest rates in age group 35 to 44 after which rates rose geometrically. Acute myeloid leukemia had only a very small childhood peak with a low in the age group 5 to 9, after which the rates also rose geometrically. For both chronic lymphatic and myeloid leukemia the rates rose geometrically after age 15. Rates among females were consistently lower for each age group. The highest sex ratio was found for chronic lymhatic leukemia and is proposed to be the result of a lag period between male and female rates. During the period under study acute lymphatic leukemia mortality in adults declined by almost 10% while acute myeloid leukemia mortality increased by almost 20%. Analysis of the geographic variation of the four major cell types revealed a geographic association between acute lymphatic and acute myeloid leukemia in children, a lack of association between childhood and adult cell types and an association of acute and chronic cell types in adults.

5530 Agriculture And Food Technology

13139 **(TVA/OACD—83/2) Situation 82. Bulletin Y-174.** (National Fertilizer Development Center, Muscle Shoals, AL (USA)). 1982. 79p. (CONF-8208102—). NTIS, PC A05/MF A01. Order Number DE83900363.

From TVA fertilizer conference; St. Louis, MO, USA (18 Aug 1982).

Topics discussed were: Outlook for Agricultural and Food Policy; Soil Test Recommendations; Considerations for Fall and Spring Applied Nitrogen; Ammonia Agronomics; Economics of Fertilizers; Fertilizer Supply; New Laws for Agricultural Leasing; The Farmers Marketing Dilemma; Agromanic Consulting; and Future of Fertilizer Industry.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 11928, 11929, 12416, 12826, 13113, 13129, 13176, 13186, 13191, 13392

13140 **(DOE/EP/12040—T1) Radiation-induced risk of resettling Bikini atoll. Final report, November 7, 1981-May 28, 1982.** Kohn, H.I.; Dreyer, N.A. (Epidemiology Resources, Inc., Chestnut Hill, MA (USA)). 1982. Contract AC01-82EP12040. 56p. NTIS, PC A04/MF A01. Order Number DE82015865.

Portions of document are illegible.

The Department of Energy (DOE) has concluded that the Bikini atoll is unsafe for resettlement. In response to the Bikinians' request for an independent review, we have examined the following DOE findings: (a) radionuclide contamination of Eneu and Bikini Islands, (b) radiation dosage to those who might resettle the islands, and (c) risks to the health of such settlers. We are in practical agreement with the DOE estimates. Resettlement of either island in 1983 would lead to a range of annual or 30-year cumulative doses that exceed the Federal Radiation Council (FRC) guides for the general population, but not those for occupation exposure. By 2013 resettlement of Eneu probably would be permissible. The principal source of radiation dose is local food, especially coconut, owing to contamination of the soil by cesium-137. A precise estimate of dose is impossible. The availability of imported foods would lessen local food consumption, but not sufficiently to meet the FRC guides for the general population. The 30-year cumulative index dose is 61 (25-122) rem for Bikini, and about 8 (3-16) rem for Eneu.

13141 **(DOE/EV/03380—38) Oncogenic action of ionizing radiation on rat skin. Comprehensive progress report, February 1, 1980-January 31, 1983.** Burns, F.J. (New York Univ., NY (USA). Dept. of Environmental Medicine). 1982. Contract AC02-76EV03380. 78p. NTIS, PC A05/MF A01. Order Number DE83004642.

Portions of document are illegible.

The carciongenic response of rat skin to ionizing radiation has been studied. A model of radiation carcinogenesis is being developed where it is assumed that the tumor yield can be related to moleuclar changes in the DNA occurring in phase 1 and that phase 2 exerts approximately the same effect on tumor development, regardless of the radiation dose. (ACR)

13142 **(DOE/RL—82-4) 1976 Hanford americium exposure incident: overview and perspective.** Thompson, R.C. (Pacific Northwest Lab., Richland, WA (USA)). 1982. Contract AC06-76RL01830. 30p. NTIS, PC A03/MF A01. Order Number DE83004030.

Salient features of the 1976 Hanford americium exposure incident are discussed. Comparisons are made with previous human and animal exposure data, and conclusions drawn relative to the injured workman, to health physics practices, and to the adequacy of current exposure limits.

13143 **(DOE/RL—82-6) 1976 Hanford americium exposure incident: medical management and chelation therapy.** Breitenstein, B.D. (Hanford Environmental Health Foundation, Richland, WA (USA)). 1982. Contract AC06-76RL01830. 34p. NTIS, PC A03/MF A01. Order Number DE83004028.

A chronological account is given of the general medical management of a patient involved in an americium exposure incident.

13144 **(DOE/RL—82-7) 1976 Hanford americium exposure incident: psychological aspects.** Brown, W.R. (Hanford Environmental Health Foundation, Richland, WA (USA)). 1982. Contract AC06-76RL01830. 16p. NTIS, PC A02/MF A01. Order Number DE83004027.

Accidents involving exposure to radiation or radioactive materials may involve an unusual degree of emotional trauma. Methods that may be employed in dealing with such trauma are discussed in relation to a specific accident in which a radiation worker was injured and seriously contaminated with americium-241.

13145 **(DOE/RL—82-8) 1976 Hanford americium-exposure incident: external decontamination procedures.** Jech, J.J.; Berry, J.R.; Breitenstein, B.D. (Pacific Northwest Lab., Richland, WA (USA); Hanford Environmental Health Foundation, Richland, WA (USA)). 1982. Contract AC06-76RL01830. 24p. NTIS, PC A02/MF A01. Order Number DE83004026.

An accident resulted in the deposition on an injured workman's skin surfaces, in acid-burned areas and in lacerations, of something in excess of 6 mCi americium-241. The external decontamination procedures used, the change in americium content of the skin during the course of treatment, and some of the unusual problems encountered from the extrusion of foreign material and flaking of skin and scar tissue are described.

13146 **(DOE/RL—82-9) 1976 Hanford americium-exposure incident: decontamination and treatment facility.** Berry, J.R.; McMurray, B.J.; Jech, J.J.; Breitenstein, B.D.; Quigley, E.J. (Pacific Northwest Lab., Richland, WA (USA); Hanford Environmental Health Foundation, Richland, WA (USA)). 1982. Contract AC06-76RL01830. 25p. NTIS, PC A02/MF A01. Order Number DE83004025.

An injured worker, contaminated with over 6 mCi of americium-241, required special treatment and housing for 4 months. This paper is a description of the design and management of the facility in which most of the treatment and housing occurred. The problems associated with contamination control, waste handling, supplies, and radiological concerns during the two-stage transfer of the patient from a controlled situation to his normal living environment are discussed in detail.

13147 **(DOE/RL—82-10) 1976 Hanford americium exposure incident: in vivo measurements.** Palmer, H.E.; Rieksts, G.A.; Icayan, E.E. (Pacific Northwest Lab., Richland, WA (USA); Hanford Environmental Health Foundation, Richland, WA (USA)). 1982. Contract AC06-76RL01830. 49p. NTIS, PC A03/MF A01. Order Number DE83004024.

Detailed external measurement were made of internally deposited ^{241}Am in a nuclear chemical operator involved in an americium exposure accident at the Hanford plant. Despite some interference from high-level external contamination, quantitative measurements of the ^{241}Am content in the lung, liver, and bones were made starting on the third day after the accident. The rate of excretion of ^{241}Am from these organs was determined. The ^{241}Am embedded in the skin of the face and head was carefully mapped. The distribution over the total length of the body was also determined. Linear and rectilinear scanners, gamma cameras, large and small scintillation detectors, proportional counters, and Si(Li) and intrinsic germanium detectors were used to evaluate the internal deposition. Methods of calibration for quantitative measurement included simulation of the ^{241}Am activity in both phantom and cadaver parts.

13148 **(DOE/RL—82-11) 1976 Hanford americium exposure incident: organ burden and radiation dose estimates.** Robinson, B.; Heid, K.R.; Aldridge, T.L.; Glenn, R.D. (Pacific Northwest Lab., Richland, WA (USA)). 1982. Contract AC06-76RL01830. 32p. NTIS, PC A03/MF A01. Order Number DE83004023.

A Hanford worker received an intake of ^{241}Am by skin absorption and inhalation which was later evaluated to be in excess of 1 mCi. The skin was the main pathway for introduction of ^{241}Am into the body; however inhalation was also a significant pathway. Intensive DTPA therapy prevented 99% of ^{241}Am which entered the body stream from being deposited in the internal organs. Retention and distribution of ^{241}Am in various internal organs and tissues was determined from sequential measurements in vivo using several arrangements of externally located scintillation detectors. The organ and tissue retention and distribution have been followed for over 5 years. Excretion patterns and estimates of radiation dose to the lung, liver, bone, and skin are described.

13149 **(DOE/RL—82-12) 1976 Hanford Americium exposure incident: hematologic effects.** Ragan, H.A.; Mahaffey, J.A.; Breitenstein, B.D. (Pacific Northwest Lab., Richland, WA (USA); Hanford Environmental Health Foundation, Richland, WA (USA)). May 1982. Contract AC06-76RL01830. 34p. NTIS, PC A03/MF A01. Order Number DE83004063.

Hematologic evaluation of an individual with an initial systemic body burden of $\sim$ 200 μCi ^{241}Am revealed a significant ($P < 0.01$) reduction of total leukocytes, neutrophils, and lymphocytes. This effect on total leukocytes and neutrophils was evident $\sim$ 30 days after exposure, appeared to stabilize at about 3 months after exposure, and remained at this lower level thorugh a 52-months observation period. The effect on lymphocytes was apparent by 3 days after exposure, stabilizing at $\sim$ 50% of pre-exposure values for about 7 months, with a return to pre-exposure levels in the following 4 y. There was a progressive and significant ($P < 0.001$) decline in platelet counts during the 52-months postexposure period. The pattern of response in erythrocyte parameters was complex. Immediately after the accident, these values were less than the pre-exposure mean level; they gradually increased ($P < 0.001$) for $\sim$ 2 y and then began a progressive decline ($P < 0.001$).

13150 **(DOE/RL—82-13) 1976 Hanford americium-exposure incident: histologic and autoradiographic observations on skin.** Hampton, J.C. (Pacific Northwest Lab., Richland, WA (USA)). 1982. Contract AC06-76RL01830. 10p. NTIS, PC A02/MF A01. Order Number DE83004062.

Examination of biopsies from exposed and relatively unexposed areas of the face revealed changes that were consistent with actinic elastic degeneration associated with solar exposure, except in the areas in which sources of alpha radiation were detected in the upper dermis. In those areas particles judged to be ion exchange resin were found within a few macrophages and extracellularly among connective tissue fibers. Elastic fibers in those areas showed more advanced degenerative change than fibers not closely associated with heavy concentrations of alpha radiation.

13151 **(DOE/RL—82-14) 1976 Hanford americium-exposure incident: urinary excretion of trace metals during DTPA treatments.** Kalkwarf, D.R.; Thomas, V.W. Jr.; Nielson, K.K.; Mauch, M.L. (Pacific Northwest Lab., Richland, WA (USA)). 1982. Contract AC06-76RL01830. 28p. NTIS, PC A03/MF A01. Order Number DE83004074.

Urine samples from a person treated intravenously with diethylenetriaminepentaacetate (DPTA) salts for 3 years to promote the excretion of ^{241}Am were assayed for 24 elements including almost all of the trace metals currently recognized as essential for good health. Zinc was found to be the only metal excreted more rapidly than normal. An 18-mg urinary loss of body zinc was found to be associated with each 1-g injection of $Na_3CaDTPA$. Use of either $Na_3ZnDTPA$ or $Na_3CaDTPA$ combined with oral dosages of $ZnSO_4$ appeared to completely compensate for this loss, and it is unlikely that the patient experienced any zinc deficiency due to the DTPA treatment.

13152 **(LA-UR—82-3658) Flow cytometric quantification of radiation responses of murine peritoneal cells.** Tokita, N.; Raju, M.R. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 20p. (CONF-8210110—1). NTIS, PC A02/MF A01. Order Number DE83004744.

From International symposium on biological dosimetry; Neherberg, F.R. Germany (14 Oct 1982).

Methods have been developed to distinguish subpopulations of murine peritoneal cells, and these were applied to the measurement of early changes in peritoneal cells after irradiation. The ratio of the two major subpopulations in the peritoneal fluid, lymphocytes and macrophages, was measured rapidly by means of cell volume distribution analysis as well as by hypotonic propidium iodide (PI) staining. After irradiation, dose and time dependent changes were noted in the cell volume distributions: a rapid loss of peritoneal lymphocytes, and an increase in the mean cell volume of macrophages. The hypotonic PI staining characteristics of the peritoneal cells showed two or three distinctive G_1 peaks. The ratio of the areas of these peaks was also found to be dependent of the radi-

ation dose and the time after irradiation. These results demonstrate that these two parameters may be used to monitor changes induced by irradiation (biological dosimetry), and to sort different peritoneal subpopulations.

13153 (NUREG/CR—2832, pp 25-30) **Retention and translocation of uranium following subcutaneous implantation in rats of yellowcake powder from two uranium mills.** Damon, E.G.; Edison, A.F. Dec 1982. NTIS, PC A04/MF A01 - GPO $4.75.

In Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982.

Studies were initiated to determine the pattern of retention and translocation of uranium following subcutaneous implantation of soluble or insoluble yellowcake powders in rats. Yellowcake powder from uranium Mill A consisting of 82% ammonium diuranate (ADU) and 18% U_3O_8, or from Mill D consisting of 25% ADU and 75% U_3O_8 was subcutaneously implanted via a 1 cm incision in the mid-dorsal thoracic region. The rats were serially sacrificed and the tissues analyzed by fluorometry to determine their uranium content. Two-component exponential curves were fitted to the data to determine the pattern of clearance of uranium from the soft tissue surrounding the implantation site. For the more soluble (Mill A) yellowcake, 61% of the uranium cleared very rapidly and 39% had a clearance half-time (T/sub 1/2/) of 7 days. For the less soluble (Mill D) yellowcake, 72% of the uranium ad T/sub 1/2/ = 1.1 day and the T/sub 1/2/ for the remaining 28% was 50 days. At 32 days after implantation, 1.8% of the implanted uranium from Mill A yellowcake (more soluble) remained at the implantation site while 18% for Mill D yellowcake (less soluble) remained. It was concluded that the in vivo clearance rate of uranium in rats exposed to yellowcake depends on the solubility of the uranium compounds.

13154 (NUREG/CR—2832, pp 31-42) **Comparison of infrared analysis and in vitro dissolution results with clearance of inhaled uranium in rats exposed to yellowcake aerosols.** Damon, E.G.; Eidson, A.F.; Griffith, W.C. Dec 1982. NTIS, PC A04/MF A01 - GPO $4.75.

In Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982.

A study was conducted to assess the retention of uranium in the lungs of rats that inhaled aerosols of yellowcake powders obtained from two mills (Mill A and Mill D). Analysis by infrared absorption indicated Mill A yellowcake contained 82% ammonium diuranate (ADU) and 18% U_3O_8. The Mill D powder contained 25% ADU and 75% U_3O_8. In vitro dissolution studies indicated for the Mill A sample, ~ 85% of the uranium had a dissolution half-time (T/sub 1/2/) of < 1 day, with the remainder dissolving with a half-time of 500 days. For the Mill D sample, 25% had T/sub 1/2/ < 1 day and 75% had T/sub 1/2 = 300 days. Groups of 50 rats were exposed by nose-only inhalation to either the Mill A or Mill D yellowcake. Rats were serially exposed by nose-only inhalation to either the Mill A or Mill D yellowcake. Rats were serially sacrificed in groups of 5 during six months after exposure. Selected tissues were assayed fluorometrically to determine their uranium content. The mean uranium lung burden of 5 rats sacrificed 2 hr after exposure to each material was used to represent the initial lung burden of all exposed rats. The lung burdens at sacrifice, expressed as a percentage of the initial lung burden were higher in rats exposed to the less soluble yellowcake than in rats exposed to the more soluble yellowcake. For the more soluble yellowcake, 78% initial lung burden cleared with T/sub 1/2/ = 0.5 days, and 22% with T/sub 1/2/ = 240 days. For the less soluble yellowcake, 25% initial lung burden cleared with T/sub 1/2/ = 3.5 days and 75% with T/sub 1/2/ = 110 days. Thus, the in vitro dissolution data approximated the in vivo data for uranium retention in rat lung. The T/sub 1/2/ values for the two materials approximate those expected for Class D (T/sub 1/2/ = 0.5 days) and Class Y (T/sub 1/2/ > 100 days) materials.

13155 (NUREG/CR—2832, pp 43-47) **Two-year dose pattern studies of inhaled yellowcake in the Beagle dog.** Eidson, A.F.; Damon, E.G. Dec 1982. NTIS, PC A04/MF A01 - GPO $4.75.

In Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982.

Forty-four Beagle dogs were exposed to aerosols generated from yellowcake samples obtained from two uranium mills. The two materials presented two extremes in yellowcake composition that occur in industry: one was 100% ammonium diuranate and the other was > 99% U_3O_8. Sufficient data are available now to report the exposures of 20 dogs to the 100% ammonium diuranate aerosol. The aerosols inhaled by 20 dogs averaged 3.4 +- 0.5 microns (mean +- 1 standard error) mass median aerodynamic diameter and 1.5 +- 0.04 geometric standard deviation. The average estiated initial lung burdenw as 130 +- 9 μg U/kg body weight. Sacrifices are completed through 64 days after exposure for both experiments and analysis of tissue and excreta samples for uranium content is in progress.

13156 (PNL-SA—9576) **Measurements to determine the solubility of uranium yellowcake materials in the lungs of millworkers following acute exposure.** Spitz, H.B.; Robinson, B. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1981. Contract AC06-76RL01830. 16p. (CONF-8210102—1). NTIS, PC A02/MF A01. Order Number DE83002741.

From International meeting on the radiobiology of radium and the actinides in man; Lake Geneva, WI, USA (12 Oct 1982).

Portions of document are illegile.

Experience indicates that, although most acute inhalation exposure to yellowcake is followed by rapid excretion of uranium, examples demonstrate that some yellowcake is significantly less soluble in the lung than expected. These cases of yellowcake exposure support findings from other solubility studies conducted in vitro which demonstrate that yellowcake does not exhibit a generically unique solubility classification. The methodology employed in this program is illustrated and a range of solubility for yellowcake is established based upon occupational exposure experience.

13157 (SAND—82-1550) **Bibliography of the Beneficial Uses/Sewage-Sludge-Irradiation Project, 1974-1982.** Homann, P.S.; Hartwigsen, C.C.; Zak, B.D. (comps.). (Sandia National Labs., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 130p. (TTC—0390). NTIS, PC A07/MF A01. Order Number DE83004760.

The goal of the Beneficial Uses/Sewage Sludge Irradiation Project is to develop the technology to disinfect sewage sludge by treatment with gamma radiation from nuclear waste material, and to use the treated sewage sludge as a soil amendment or supplemental animal feed. Since the inception of the project in 1974, several hundred reports and articles have been published that describe the project work supported by Sandia National Laboratories and the Albuquerque Operations Office of the Department of Energy. This Bibliography presents citations and abstracts of those publications. Also listed are several publications describing pertinent work supported by other organizations.

13158 **Review of dosimetry for the atomic bomb survivors.** Kerr, G.D. (Oak Ridge National Lab., TN). *Nuclear Safety;* **23**: No. 5, 563-571(Sep-Oct 1982).

An up-to-date review of dosimetry for the atomic bomb survivors was recently requested by the National Council on Radiation Protection through the US Department of Energy. The primary purpose of the review was to determine if the large leukemia risk found by Rossi and Mays at low neutron exposure levels in Hiroshima was real or if it was the result of a bias in the current T65D system of dosimetry for the atomic bomb survivors. The possibility of a bias existed because the Nagasaki and Hiroshima weapons were of radically different design and construction. This article summarizes and discusses results of some 1980-1981 studies of neutron and gamma-ray exposure to the atomic bomb survivors by W.E. Loewe and E. Mendelsohn of the Lawrence Livermore National Laboratory, D.C. Kaul and W.H. Scott of Science Applications, Inc., and J.V. Pace of the Oak Ridge National Laboratory. Other special studies that are now under way to complete the review are also discussed. The expert assistance of others in these special studies is being supported in part by the US Department of Energy and in part by the US Defense Nuclear Agency.

13159 Application of a surplus production model to assess environmental impacts on exploited populations of Daphnia pulex in the laboratory. Jensen, A.L. (Michigan Univ., Ann Arbor (USA). School of Natural Resources); Marshall, J.S. (Argonne National Lab., IL (USA)). *Environmental Pollution, Series A: Ecological and Biological;* **28**: No. 4, 273-280(Aug 1982).

The surplus production model is a simple and easily applied model for the assessment of environmental impacts on exploited fish populations. However, its application requires several assumptions about the relationships between the degree of impact and the population response that are difficult to test using field data. To examine these assumptions, the model is applied to exploited laboratory populations of Daphnia pulex exposed to chronic radiation stress. The model describes the observed relationship between equilibrium population size and the level of radiation exposure. It also describes the relationship between yield and population size.

13160 Ligase-deficient yeast cells exhibit defective DNA rejoining and enhanced gamma ray sensitivity. Moore, C.W. (Univ. of Rochester, NY). *Journal of Bacteriology;* **150**: No. 3, 1227-1233(Jun 1982).

Yeast cells deficient in DNA ligase were also deficient in their capacity to rejoin single-strand scissions in prelabeled nuclear DNA. After high-dose-rate gamma irradiation (10 and 25 krads), cdc9-9 mutant cells failed to rejoin single-strand scissions at the restrictive temperature of 37°C. In contrast, parental (CDC9) cells (incubated with mutant cells both during and after irradiation) exhibited rapid medium-independent DNA rejoining after 10 min of post-irradiation incubation and slower rates of rejoining after longer incubation. Parental cells were also more resistant than mutant cells to killing by gamma irradiation. Approximately 2.5 +- 0.07 and 5.7 +- 0.6 single-strand breaks per 10^8 daltons were detected in DNAs from either CDC9 or cdc9-9 cells converted to spheroplasts immediately after 10 and 25 krads of irradiation, respectively. At the permissive temperature of 23°C, the cdc9-9 cells contained 2 to 3 times the number of DNA single-strand breaks as parental cells after 10 min to 4 h of incubation after 10 krads of irradiation, and two- to eightfold more breaks after 10 min to 2.5 h of incubation after 25 krads of irradiation. Rejoining of single-strand scissions was faster in medium. After only 10 min in buffered growth medium after 10 krads of irradiation, the number of DNA single-strand breaks was reduced to 0.32 +- 0.3 (at 23°C) or 0.21 +- 0.05 (at 37°C) per 10^8 daltons in parental cells, but remained at 2.1 +- 0.06 (at 23°C) or 2.3 +- 0.07 (at 37°C) per 10^8 daltons in mutant cells. After 10 or 25 krads of irradiation plus 1 h of incubation in medium at 37°C, only DNA from CDC9 cells was rejoined to the size of DNA from unirradiated cells, whereas at 23°C, DNAs in both strains were completely rejoined.

13161 Differential responses of log and stationary phase human fibroblasts to inhibition of DNA repair by aphidicolin. Snyder, R.D. (Tennessee Univ., Oak Ridge (USA). Graduate School of Biomedical Sciences); Regan, J.D. (Oak Ridge National Lab., TN (USA)). *Biochim. Biophys. Acta - Gene Struct. Expr.;* **697**: No. 2, 229-234(31 May 1982).

The tetracyclic diterpenoid, aphidicolin, is an effective inhibitor of DNA repair in human cells following ultraviolet irradiation. This inhibition is very efficient in confluent resting cells but not in rapidly cycling cells as measured by (1) analysis of DNA single-strand breaks by alkaline sucrose sedimentation, (2) chromatographic analysis of pyrimidine-dimer removal, and (3) repair replication using CsCl density centrifugation. The inhibition is reversed by deoxycytidine or thymidine but not by deoxyadenosine or deoxyguanosine during the repair period. The data suggest that differences in deoxynucleoside triphosphate pools between cycling and confluent resting cells determine the different efficacies of the agent in these two situations.

13162 Comparative action spectra for pyrimidine dimer formation in Cloudman S91 mouse melanoma and EMT6 mouse mammary carcinoma cells. Hill, H.Z. (New Jersey, Medical School, Newark (USA)); Setlow, R.B. (Brookhaven National Lab., Upton, NY (USA)). *Photochemistry and Photobiology;* **35**: No. 5, 681-684(May 1982).

Pyrimidine dimer formation in melanotic mouse melanoma cells, Cloudman S91H-, and in mouse mammary carcinoma cells, EMT6, was compared as a function of wavelength by irradiating equal numbers of cells from the two cell lines simultaneously. More dimers were formed in EMT6 than in S91H- by light of wavelengths less than 289nm, while light of higher wavelengths caused equivalent dimer formation, as measured by the Micrococcus luteus UV-endonuclease assay. The cells of S91H- are lightly melanotic, yet shielding at lower wavelengths is considerable. It is speculated that melanin pigmentation arose by selection during an evolutionary period when UV-C light reaching the earth's surface was significantly greater than it is today.

13163 Single-strand breaks induced in Bacillus subtilis DNA by ultraviolet light: action spectrum and properties. Peak, M.J.; Peak, J.G. (Argonne National Lab., IL (USA)). *Photochemistry and Photobiology;* **35**: No. 5, 675-680(May 1982).

The induction of single-strand breaks (alkali-labile bonds plus frank breaks) in the DNA of Bacillus subtilis irradiated in vivo by monochromatic UV light at wavelengths from 254 to 434nm was measured. The spectrum consists of a major far-UV (below 320nm) component and a minor near-UV shoulder. A mutant deficient in DNA polymerase I accumulates breaks caused by near-UV (above 320nm) wavelengths faster than the wild-type strain proficient in polymerase I. Measurable breaks in extracted DNA are induced at a higher frequency than those induced in vivo. Anoxia, glycerol, and diazobicyclo (2.2.2.) octane inhibit break formation in extracted DNA. Alkali-labile bonds induced by 365-nm UV radiation are largely (78%) covalent bond chain breaks, the remainder consists of true alkali-labile bonds, probably apurinic and apyrimidinic sites.

13164 Nonreciprocal synergistic lethal interaction between 365-nm and 405-nm radiation in wild type and uvrA strains of Escherichia coli. Webb, R.B.; Brown, M.S.; Ley, R.D. (Argonne National Lab., IL (USA)). *Photochemistry and Photobiology;* **35**: No. 5, 697-703(May 1982).

Lethality by 405-nm radiation in three repair-proficient and two uvrA strains of Escherichia coli was greatly enhanced by prior exposures to 365-nm radiation at fluences greater than $1x10^6 Jm^{-2}$. Fluences at 365nm that yielded a surviving fraction of 0.10 in the 5 strains tested resulted in the following 405-nm fluence enhancement factors strain K12 AB1157 (wild type), 8.7; strain B/r (wild type), 52; strain WP2 (wild type), 25; strain WP2s (uvrA), 13; strain K12 AB1886 (uvrA), 15. The maximal 405-nm FEF value obtained after a prior 365-nm irradiation at greater fluences was 83 in the wild-type strain B/r. Enhancement of anoxic 405-nm radiation after a prior aerobic 365-nm exposure was not detectable. Single-strand breaks were produced by 405-nm radiation at $3.0x10^{-5}$ breaks per $2.5x10^9$ daltons per Jm^{-2} in the polA strain P3478; pyrimidine dimers were not detected by biological assay (photoreactivation) at 405nm. It is suggested that the strong synergistic effect of 365-nm irradiation on 405-nm lethality is the consequence of pronounced inhibition by 365-nm radiation of components of the DNA-repair systems that can mend or bypass damage produced by 405-nm radiation.

13165 Distribution of inhaled $^{239}PuO_2$ in rat and hamster lung. Rhoads, K.; Mahaffey, J.A.; Sanders, C.L. (Pacific Northwest Lab., Richland, WA (USA)). *Health Physics;* **42**: No. 5, 645-656(May 1982).

The distribution of inhaled $^{239}PuO_2$ in rat and hamster lung was investigated up to one year postexposure to determine whether differences in pulmonary dose distribution could account for the apparent difference between the two species in lung tumor response. In previous life-span studies, rats developed up to 70% lung tumors at cumulative doses less than 2000 rads, whereas hamsters developed tumors in about 3% of animals at comparable or higher doses. Morphometric methods were used to quantitate the particle distribution in different lung regions of both species following exposure at levels that produced tumors in rats. The PuO_2 particles were counted on autoradiograms of lung cross-sections and classified as to their location in either subpleural or internal parenchyma, lung vasculature, or major airways. Rat lung showed a greater long-term association of particles with the major airways than hamster lung. The particles also showed a greater tendency to occur in groups for rats, the difference being more pronounced in the subpleural

region. In previous experiments, both bronchioles and subpleural fibrotic scars appeared to be the sites of origin for lung tumors. Different dose distributions within these regions may therefore affect the tumor response to inhaled $^{239}PuO_2$.

13166 **Retention of ^{226}Ra in human soft tissue and bone; implications for the ICRP 20 alkaline earth model.** Schlenker, R.A.; Keane, A.T.; Holtzman, R.B. (Argonne National Lab., IL (USA)). *Health Physics;* **42**: No. 5, 671-693(May 1982).

The ICRP model of alkaline earth metabolism was adjusted to fit data on the ^{226}Ra content of 87 samples of soft tissue from 17 persons who received radium by injection or ingestion 5 days to 53 yr before measurement. The fitted functions indicate that soft tissue retention rises to 58% of the whole body retention at 18 days after single intake, and then falls steadily reaching 33% at 100 days and 6% at 1000 days. The model also fitted data on bone retention in 5 persons 8-467 days after injection. For both types of tissue, the new functions differ substantially from those originally published. The adjustments improve or do not significantly reduce the model's ability to fit other radium data.

13167 **Effects of monomeric ^{239}Pu on the pregnant rabbit.** Kelman, B.J.; Sikov, M.R.; Hackett, P.L. (Pacific Northwest Lab., Richland, WA (USA)). *Health Physics;* **42**: No. 5, 730-731(May 1982).

The effects of ^{239}Pu treatment (0, 10 or 40 μCi/kg) on hematological measurements in pregnant rabbits were studied at 29 days of gestation. Mean clotting times were significantly increased in all plutonium-treated rabbits. There was also a significant increase in clotting time with increasing time between plutonium dosing and sample collection in rabbits injected with 10 μCi/kg. Platelet counts were significantly decreased in all rabbits exposed to ^{239}Pu for 14 days or greater. Hematocrits were significantly depressed in rabbits exposed to ^{239}Pu for 20 days. It is speculated that monomeric ^{239}Pu accumulates at a hematopoietic site close to that affected in X-irradiated animals.

13168 **Effect of mutations in the uthetarD cistron of Escherichia coli on repair resynthesis.** Kuemmerle, N.B.; Ley, R.D.; Masker, W.E. (Oak Ridge National Lab., TN (USA). Biology Div.). *Mutation Research;* **94**: 285-297(1982).

The resynthesis step of the excision repair pathway has been examined in Escherichia coli K12 strains isogenic except for mutations in the uvrD cistron. Strains mutant at the uvrD3, uvrD101, uvrE156, and recL152 loci exhibited slight but distinct differences in their response to ultraviolet radiation. The repair capacity of the uvrD101 mutant was given special attention. Repair resynthesis in this mutant was saturated at fluences greater than about 20 J/m^2. Isopycnic analysis of repaired deoxyribonucleic acid from this strain revealed a two-fold increase over its wild-type counterpart in the amount of repair replication performed after a dose of 15 J/m^2. Sedimentation velocity analysis of DNA after selective photolysis of bromouracil-containing repaired regions showed that the uvrD101 mutation exerted its primary effect on the long-patch component of excision repair. The uvrD101 mutant performed long-patch repair at a larger number of sites than the number repaired by this mode in the wild-type strain; these patches were more extensive in length than the long-patch component in wild-type.

13169 **Differential responses of log and stationary phase human fibroblasts to inhibition of DNA repair by aphidicolin.** Snyder, R.D.; Regan, J.D. (Oak Ridge National Lab., TN). *Biochimica et Biophysica Acta;* **697**: 229-234(1982). Contract W-7405-ENG-26.

The tetracyclic diterpenoid, aphidicolin, is an effective inhibitor of DNA repair in human cells following ultraviolet irradiation. This inhibition is very efficient in confluent resting cells but not in rapidly cycling cells as measured by (1) analysis of DNA single-strand breaks by alkaline sucrose sedimentation, (2) chromatographic analysis of pyrimidine-dimer removal, and (3) repair replication using CsCl density centrifugation. The inhibition is reversed by deoxycytidine or thymidine but not by deoxyadenosine or deoxyguanosine during the repair period. The data suggest that differences in deoxynucleoside triphosphate pools between cycling and confluent resting cells determine the different efficacies of the agent in these two situations.

13170 **Radiation hazards in mining: control, measurement, and medical aspects.** Gomez, M. (ed.). New York, NY; American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (1981). 1121p. (CONF-8110111—).

From International conference on radiation hazards in mining: control, measurement, and medical aspects; Golden, CO, USA (4 Oct 1981).

Separate abstracts were prepared for 148 of the 163 chapters of this symposium on radiation hazards in mining. Those chapters not abstracted were duplicates that have already been entered into the EDB. (KRM)

13171 **Dose to basal cells in bronchial epithelium from long-lived alpha emitters in uranium mines.** Harley, N.H. (New York Univ. Medical Center, NY); Bohning, D.E.; Fisenne, I.M. pp 36-41 of Radiation hazards in mining: control, measurement, and medical aspects. Gomez, M. (ed.). New York, NY; American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (1981).

From International conference on radiation hazards in mining: control, measurement, and medical aspects; Golden, CO, USA (4 Oct 1981).

The alpha dose to basal cells in the tracheobronchial tree in a five-lobed human lung from inhaled ^{234}U and ^{238}U has been calculated. Uranium (and its long-lived daughters) is present in particulates inhaled in all mine atmospheres. Measurements of airborne ^{234}U and ^{238}U in a few samples obtained from the US Bureau of Mines indicated the presence of 15 dpm/m^3 of ^{238}U and ^{234}U at the ore body face in a mine in New Mexico where wet drilling was used and about 3.5 dpm/m^3 each in a mine in Colorado using dry drilling. A maximum alpha dose of about 100 mrad/year can be calculated from the higher concentration from ^{234} ^{238}U, and 2 to 3 times this values is estimated if some of the long-lived daughters of ^{238}U are present. Thus, long-lived alpha activity could account for a maximum alpha dose that is about 10% of that allowed occupationally from short-lived ^{222}Rn daughters in mine atmospheres.

13172 **DNA damage and carcinogenesis.** Setlow, R.B. (Brookhaven National Lab., Upton, NY). pp 575-584 of Chromosome damage and repair. Seeberg, E.; Kleppe, K. (eds.). New York, NY; Plenum Publishing Corporation (1981).

Although cancer may arise as a result of many different types of molecular changes, there is little reason to doubt that changes to DNA are one of the more important ones in cancer initiation. Although DNA repair mechanisms seem able to eliminate a very large fraction of deleterious changes to DNA, we not only have little insight into the molecular mechanisms involved in such repair, but have a negligible amount of information to permit us to estimate the shape of dose response relations at low doses. The case of skin cancer is a special one, in that the average population is exposed to sufficient solar UV so that the effects of small increments in UV dose may be estimated. An approximate 85% reduction in DNA repair increases skin cancer incidence 10^4 fold.

13173 **(ORNL-tr—4909) Fission of natural uranium in tumor and normal tissue.** Kukiel, E.; Majewski, C.; Wszolek, B. Translated from *Patologia Polska ;* **18**: No. 2, 231-237(1967). Contract W-7405-ENG-26. 12p. NTIS, PC A02/MF A01. Order Number DE83001764.

Using the technology of tracer autoradiography we investigated tumors tissue removed surgically from a kidney because of clear-cell cancer (carcinoma clarocellulare), as well as tissue from the inferior pole of the kidney presumed to be normal on the basis of the results of histologic examination. It was found that nine cases of natural uranium fission were recorded in the tumorous tissue, while there was only one fission process in the tissue presumed to be normal. It is assumed that the single fission process could occur because of spontaneous fission of the uranium. A suggestion is made that the remaining cases of fission could be of neutron origin.

13174 **DNA repair, aging, and cancer.** Setlow, R.B. (Brookhaven National Lab., Upton, NY). *National Cancer Institute Monograph;* No. 60, 249-255([nd]). Contract AC02-76CH00016.

From International symposium on aging and cancer; Washington, DC, USA (21 Sep 1980).

The ability of cells to repair uv damage to DNA is closely associated with a reduction in skin cancer incidence, and the quantitative epidemiological data indicate that proficient repair systems reduce cancer incidence by as much as 10,000-fold. The latter decrease corresponds to an equivalent reduction in uv dose of sevenfold to twentyfold. Older cells may accumulate DNA damage, but this accumulation does not seem to be the result of a deterioration of the repair systems studied to date. Although a correlation has been described between life-span and the proficiency of nucleotide excision repair and the association between cellular aging and decreasing repair is much weaker, no definitive data indicate whether these relations are causal ones.

5602 Thermal Effects

13175 **(NUREG/CR—2727-Vol.3) Ecological studies of wood-boring bivalves in the vicinity of the Oyster Creek Nuclear Generating Station. Progress report, March-May 1982.** Hoagland, K.E. (Academy of Natural Sciences of Philadelphia, PA (USA). Dept. of Malacology). Nov 1982. 38p. NTIS, PC A03/MF A01. Order Number DE83900850.

The species composition, distribution, and population dynamics of wood-boring bivalves are being studied in the vicinity of the Oyster Creek Nuclear Generating Station, Barnegat Bay, New Jersey. Untreated wood test panels are used to collect organisms at 12 stations. Physiological tolerances of 3 species are also under investigation in the laboratory. Competition among the species is being analyzed. The adult population of Teredo bartschi survived the winter and spring of 1981-1982 better than it did previous cold periods without a thermal effluent. Lack of an effluent was due to a prolonged outage of the generating station. There was no spring outbreak of shipworms. The introduced species appears established at one station near but outside of Oyster Creek. Three teredinid species coexist in Oyster Creek. Larvae of T. bartschi and T. navalis have similar responses to reduced salinity. Bankia gouldi is the fastest-growing of the teredinids found in New Jersey, and as the lowest annual mortality.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 13025, 13059, 13103, 13130, 13172, 13175

13176 **(BNL—30628) Enhancement of radiopharmaceutical excretion by chemical interventions.** Oster, Z.H.; Som, P.; Brill, A.B.; Sacker, D.F.; Atkins, H.L. (Brookhaven National Lab., Upton, NY (USA); State Univ. of New York, Stony Brook (USA)). 1982. Contract AC02-76CH00016. 5p. (CONF-820804—4). NTIS, PC A02/MF A01. Order Number DE83003217.

From 3. world congress of nuclear medicine and biology; Paris, France (29 Aug 1982).

The goal was to find methods of decreasing the radiation dose after radionuclide studies, by giving a compound that will increase the rate of excretion of the radionuclide. Sprague - 1 Dawley rats were given Tc-99m pertechnetate, Ga-67 citrate or Tl-201 chloride intravenously followed at intervals of 1 to 24 hours by one of the following compounds: desferroxamine (DFO), 2,3-dimercapto-1-propanol (BAL), triethylene tetraamine hexaacetic acid (TETHA), stannous tartarate, bleomycin (BLEO), 2,3-dimercaptosuccinic acid (DMSA), diethylene-triaminepentaacetic acid (DTPA), DTPA+$SnCl_2H_2O$, dihydroxybenzoic acid (DHB), and ferric-cyanoferrate (IT)(Prussian blue, PB). All the agents except PB are chelators. Some of these agents enhance excretion through the urinary tract (DFO), while most are excreted through the bile. PB was shown to increase Cs excrection through the G.I. tract. (ACR)

13177 (CONF-801030—Vol.3, pp 1011-1012) **Biological impacts of alcohol fuel emission on selected pollinator, predatory and nutrient-cycling insects and arachnids.** D'Eliscu, P.N. (Univ. of Santa Clara, CA). Jan 1981. NTIS (US Sales Only), PC A15/MF A01.

From 4. international symposium on alcohol fuels technology; Sao Paulo, Brazil (5 Oct 1980).

Physiological and behavioral effects of methanol, ethanol, indolene, and formaldehyde emissions on selected arthropods are related to different relative organismic activities, metabolic rates, and respiratory demands. Various species of important pollinators, predators, and nutrient-cycling insects and arachnids respond differently to tailpipe and elevated levels of emissions. A gradient of responses is related to metabolism and trophic niche. Orders tested included various Hymenoptera, Diptera, Lepidoptera, Odonata, Orthoptera, Coleoptera, Collembola, Thysanura, Araneae, Acarina, and Opiliones. Responses included narcosis, spatial disorientation, cardiac arrhythmia, flight muscle and walking leg dysfunction, decreased feeding efficiency and prey capture success ratios, and increased positive thigmotaxis. Tolerance appears to be inversely related to oxygen demand of the arthropods tested, with active fliers most susceptible, weak fliers midscale, and non-fliers most tolerant. Electronic monitoring of heart, brain, and muscle characteristics suggests neuronal and neurosynaps disruptions from alcohols and formaldehyde, and neuromuscular effects from indolene in most arthropods tested.

13178 **(CONF-801039—13) Mass and mutagenicity balances in chemical fractionations.** Jirka, A.; Bourne, S.; Peak, M. (Argonne National Lab., IL (USA)). 1980. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01. Order Number DE83025791.

From 20. annual Hanford Life Sciences symposium; Richland, WA, USA (19 Oct 1980).

The question of chemical and biological change arises during fractionation of complex liquids into simpler chemical mixtures for toxicological evaluation and analysis. The more polar material is expected to be chemically most susceptible to modification in the common chromatographic or acid/base/neutral extractive separations. The methods in use at ANL have been examined for balance of both mass and mutagenic activity, with special attention given to the most-polar fractions from the coal oils. In general, the losses of mutagenic activity are somewhat larger than the losses of mass, averaging about 25% activity loss per fractionation step, with the largest losses occuring after acid/base/neutral partitioning. However, these losses cannot as yet be correlated with particular chemical classes.

13179 **(CONF-8103153—1) Parametric statistical methods and sample-size considerations for dominant lethal experiments: the use of clustering to achieve approximate normality.** Whorton, E.B. Jr. (Texas Univ., Galveston (USA). Medical Branch). 1981. Contract AS05-78EV06023. 22p. NTIS, PC A02/MF A01. Order Number DE83004581.

From Environmental Mutagen Society annual meeting; San Diego, CA, USA (7 Mar 1981).

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While the Dominant Lethal (DL) assay is often used to assess the mutagenic potential of suspect agents, questions remain concerning its sensitivity, the appropriate way to anlayze resultant data and the necessary study size. Many questions surrounding the statistical analysis methods relate to a specification of the basic independent unit of expeirmentation and analysis, the particular type of study design used and the distributional properties of the study variables. These statistical analysis issues must be resolved before adequate attention can be given to the related questions of experimental sensitivity and sample size. This report deals with the development of a statistical analysis methodology which incorporates a particular type of data clustering scheme to achieve desirables so that analysis of variance (AOV) and related parametric testing procedures can be used. Further, the differences between dose groups which can be detected using 20, 10, and 5 cluster units of 6 males and 18 females each are estimated for each variable according to the size of selected Type I and II errors. While these procedures were developed in part using data from two DL studies on the effects of differing doses of n-Butyl Glycidyl Ether in mice, the clus-

tering scheme suggested can be used with other AOV and regression procedures corresponding to the specific study desgin employed.

13180 **(DOE/EV/03221—74) Cytoxicity of vitamin C and metal ions: a site-specific Fenton mechanism. Progress report, July 1981-June 1982.** Samuni, A.; Aronovitch, J.; Godinger, D.; Chevion, M.; Czapski, G. (Hebrew Univ., Jerusalem (Israel)). 1982. Contract AC02-76EV03221. 20p. (COO—3221-74). NTIS, PC A02/MF A01. Order Number DE83004778.

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The toxicity of ascorbate toward phages T2 through T7 has been investigated. The T-odd bacteriophages are highly susceptible to ascorbate-induced damage, whereas the t-even phages are practically resistant. The toxicity of ascorbate is dependent on the presence of copper (or iron) ions and on oxygen. The dependence on oxygen does not exist in the presence of hydrogen perioxide. Hydrogen peroxide enhances the damage and is essential for the ascorbate induced biological damage, as catalase fully protects the phages. Chelating agents such as salicylate or 1,10-phenanthroline do not prevent the damage, though they reduce the rate of phage inactivation roughly 5-fold. By contrast, EDTA or histidine fully protect the phages. OH-scavengers such as sucrose, formate, mannitol, t-BuOH or polyethylene glycol do not protect. Experiments with isotopically labeled DNA indicate that both phage adsorption to the host and the injection of its DNA are impaired as a result of the exposure to ascorbate and copper. It is also possible that some failure to express the viral genetic information contributes towards the loss of phage PFA.

13181 **(DOE/EV/04267—06) Health effects of combustion-generated soot and polycyclic aromatic hydrocarbons: human cell studies. Progress report, 1977-1983.** Thilly, W.G. (Massachusetts Inst. of Tech., Cambridge (USA)). 1983. Contract AC02-77EV04267. 82p. NTIS, PC A05/MF A01. Order Number DE83004578.

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Developments in human cell culture mutation assay technology are reviewed. Exhaust particulate extracts have been analyzed for mutagenic chemicals. Studies aimed at understanding the biochemical component of the mutagenic process are presented. (ACR)

13182 **(DOE/EV/05888—05) Impact of energy-related pollutants on chromosome structure. Progress report, January 1, 1982-December 31, 1982.** Rill, R.L. (Florida State Univ., Tallahassee (USA). Inst. of Molecular Biophysics). 1982. Contract AS05-78EV05888. 6p. NTIS, PC A02/MF A01. Order Number DE83004557.

Research progress in the following studies is reported: (1) the characterization of interactions and target sites of model and real carcinogens with DNA and chromatin; and (2) the elucidation of structural details of chromatin. (ACR)

13183 **(LBL—7520-Rev.) Laser-based multiparameter system for automatic sorting of microscopic particles.** Turko, B.; Leskovar, B. (Lawrence Berkeley Lab., CA (USA)). Aug 1981. Contract AC03-76SF00098. 14p. (CONF-821011—30-Rev.). NTIS, PC A02/MF A01. Order Number DE83004189.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

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The design, characteristics and experimental results of a Laser-Based Multiparameter system for automatically sorting microscopic particles are described. The system is used mostly for the analysis of biological cells which have been stained with fluorescent dyes and suspended in liquids. The cells, passing in single file through an elliptically focused laser beam, emit fluorescent signals, which are detected by sensors and processed, first in analog fashion and then digitally by a multichannel pulse-height analyzer. The two-color fluorescent and light scatter signals give certain parameters of the particles being measured. Sorting rates of several hundred per second are attainable. The high resolution and good stability of the system ensure fast, reliable and statistically meaningful measurement of particle populations.

13184 **(NUREG/CR—2650) Allowable shipment frequencies for the transport of toxic gases near nuclear power plants.** Bennett, D.E.; Heath, D.C. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 33p. (SAND—82-0774). NTIS, PC A03/MF A01. Order Number DE83003732.

One part of the safety analysis of offsite hazards for a nuclear power plant is consideration of accidents which could release toxic gases or vapors and thus jeopardize plant safety through incapacitation of the control room operators. The purpose of this work is to provide generic, bounding estimates of the maximum allowable shipping frequencies for the transport of a chemical near the plant, such that the regulatory criteria for the protection of the operators are met. A probabilistic methodology was developed and then applied to the truck and rail transport of an example chemical, chlorine. The current regulatory criteria are discussed in detail. For this study, a maximum allowable probability of occurrence of operator incapacitation of 10^{-6} per year was used in the example calculation for each mode of transport. Comprehensive tables of conditional probabilities are presented. Maximum allowable shipping frequencies are then derived. These frequencies could be used as part of a generic, bounding criterion for the screening of toxic hazards safety analyses. Unless a transport survey assures shipping frequencies within 8 km of the plant on the order of or lower than 4/week for rail or 35/week for truck, the contol room should be isolatable and the shipping frequency then determines the degree of isolation needed. The need for isolation implies the need for toxic chemical detection at the air intake.For a self-detection case in which the smell threshold is significantly lower than the incapacitation threshold and the control room is isolatable, the corresponding trequencies are 11/week for rail or 115/week for truck. Self-contained breathing equipment is assumed to be used after 5 minutes.

13185 **Induction of ocular neoplasms in Fischer rats by intraocular injection of nickel subsulfide.** Albert, D.M.; Gonder, J.R.; Papale, J.; Craft, J.L.; Dohlman, H.G.; Reid, M.C.; Sunderman, F.W. Jr. (Massachusetts Eye and Ear Infirmary, Boston). *Investigative Ophthalmology;* **22**: No. 6, 768-782(Jun 1982).

Nickel subsulfide, αNi_3S_2, was administered to albino Fischer rats by a single injection into the vitreous body of the right eye (0.5 mg αNi_3S_2/rat, suspended in 20 µl of NaCl vehicle). Control rats received a similar injection of the vehicle. Malignant tumors developed in the injected eyes of 14/15 αNi_3S_2-treated rats by 8 months (vs. 0/11 controls, $p < 0.001$). Five of the injected eyes of αNi_3S_2-treated rats contained multiple tumors. The 21 eye tumors that were induced by αNi_3S_2 included 11 nuclanomas, four retinoblastomas, three gliomas, and three unclassified malignant neoplasms. Three of the melanomas developed extraocular extensions; one of the melanomas metastasized to lungs and brain. Although the melanomas arose from amelanotic uveal melanocytes, melanosomes were observed in electron micrographs of the tumor cells. This study provides a new experimental model for chemical induction of ocular neoplasms. As a procedure to test the carcinogenicity of nickel compounds, intraocular injection has the advantages of short lateney period, high tumor incidence, and case of tumor detection.

13186 **Monitoring ambient air for mutagenicity using the higher plant Tradescantia.** Schairer, L.A.; Sautkulis, R.C.; Tempel, N.R. (Brookhaven National Lab., Upton, NY). pp 123-140 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. (eds.). New York, NY; Plenum Publishing Corporation (1982).

The major emphasis for short-term bioassays has been placed on bacterial and mammalian cell lines. However, for increased perspective on the state-of-the-art of specific in vitro assays it is important to consider the environmental impact on whole organisms by reviewing the contributions made by in vivo assays. This paper will deal exclusively with somatic mutation in the Tradescantia stamen hair: describing the system briefly, demonstrating its relevance to environmental mutagen assessment and discussing its adaptation for in situ ambient atmosphere monitoring.

13187 **Session X: regulatory risk assessment.** Borg, D.C. (Brookhaven National Lab., Upton, NY). pp 553-554 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. (eds.). New York, NY; Plenum Publishing Corporation (1982).

The goal of the regulatory process in controlling genotoxic agents is to reduce human health hazards to acceptable or safe limits. The regulatory process is based on the premises that exposure to specific agents is a hazard to human health and that these agents can be identified, their genotoxic potency quantified, and their exposure levels controlled. Regulation is a complex process, only part of which depends on the available scientific data. Other deciding factors include societal judgments regarding the importance or desirability of the agent, the perception of risk, what constitutes acceptable risk, the feasibility of measuring and controlling the exposure conditions, and the economic impact of controls on industry and society.

13188 **Cytogehetic effects of inhaled benzene in murine bone marrow.** Tice, R.R.; Vogt, T.F.; Costa, D.L. (Brookhaven National Lab., Upton, NY). pp 257-275 of Genotoxic effects of airborne agents. Tice, R.R.; Costa, D.L.; Schaich, K.M. (eds.). New York, NY; Plenum Publishing Corporation (1982).

Using cytogenetic methodologies based on the incorporation of 5-bromodeoxyuridine (BrdUrd) into DNA, we have examined benzene's ability to induce chromosomal aberrations or SCEs and to inhibit cellular proliferation in murine bone marrow. Mice were exposed to benzene by inhalation, the normal route for human exposure, and were assessed for (i) benzene's ability to induce different kinds of genotoxic damage, (ii) the importance of concentration, age, sex and genetic constitution in modulating benzene's genotoxic potency, and (iii) the relationship between liver-specific metabolism and extrahepatic metabolism in determining the observed cytogenetic effects.

13189 **Profile analysis of organic volatiles in urine of tobacco smoke-exposed beagles.** Brazell, R.S. (Oak Ridge National Lab., TN); Jenkins, R.A.; Bayne, C.K. *Analytica Chimica Acta;* 139: 247-256(1982).

Volatile organic components were determined in the urine of beagle dogs exposed to cigarette smoke and sham in an effort to identify possible biochemical changes resulting from the exposures. The data obtained from high-resolution chromatograms were subjected to principal component and discriminant analysis. Principal component analysis was used to reduce the dimensionality of the data and discriminant analysis was used to develop a classification model. Classification of the profiles into their respective exposure groups based on quantitative variations was 92% correct using only five peaks in the rhomatograms. Compounds present in the urine of smoke-exposed dogs were identified by mass spectrometry.

13190 **Phagocytosis of particulate nickel compounds by rat peritoneal macrophages in vitro.** Kuehn, K.; Fraser, C.B.; Sunderman, F.W. Jr. (Univ. of Connecticut School of Medicine, Farmington). *Carcinogenesis (New York);* 3: No. 3, 321-326(1982).

Phagocytic indices of 17 nickel compounds were measured in vitro in monolayer cultures of rat peritoneal macrophages. The macrophages were exposed for 1 h at 37°C to particles (1.5 μm median diameter) of the nickel compounds, at concentrations of 10 μg/ml of medium (2 $\mu g/cm^2$ of monolayer). Phagocytic indices (i.e., the percentages of macrophages with one or more engulfed particles) ranged from 69% (NiO) to 3% (amorphous NiS). In order of decreasing phagocytic indices, the 17 nickel compounds were ranked as follows: NiO > Ni_4FeS_4 > $NiTiO_3$ > NiSe > αNi_3S_2 > Ni > Ni_5As_2 > NiS_2 > NiFe alloy > NiSb > $Ni_{11}As_8$ > Ni_3Se_2 > βNiS > NiTe > NiAs > NiAsS > amorphous NiS. Rank-correlation ($P < 0.03$) was observed between the phagocytic indices of the nickel compounds and their dissolution half-times in rat serum. Nickel subsulfide, αNi_3S_2, was a notable exception to the general concordance between phagocytic indices and dissolution half-times: αNi_3S_2 was avidly phagocytized by macrophages, yet it had one of the shortest dissolution half-times. Preliminary results of carcinogenesis tests of 14 of the nickel compounds do not indicate significant rank-correlation between the phagocytic indices of the nickel compounds and the sarcoma incidences at 1 yr after i.m. administration of the compounds to rats.

13191 **Screening of mutagens by inhibition of DNA synthesis.** Painter, R.B. (Univ. of California, San Francisco). pp 569-574 of DNA repair: a laboratory manual of research procedures. Volume 1. Part B. Friedberg, E.C.; Hanawalt, P.C. (eds.). New York, NY; Marcel Dekker, Inc. (1981).

The human cell DNA-synthesis inhibition test is based on the concept that lesions in human cell DNA cause an inhibition of DNA synthesis that can be detected for at least 1.5 hr after induction of those lesions. The mechanisms by which DNA-damaging agents inhibit DNA synthesis are three-fold: (1) the lesions induced by the agent may block the programmed initiation of replicating units (replicons), thus reducing with time after damage the total number of replicons in operation; (2) the lesions may block the progression of growing points already in operation, also reducing with time the number of replicons in operation; and (3) the lesions may slow the rate of chain elongation at some or all of the growing points. Most DNA-damaging agents seem to act primarily by either (1) or (2) or both. Irrespective of the mechanism, the result is a constantly decreasing overall rate of DNA synthesis until the cells repair or adapt to the lesions. DNA-damaging agents can be distinguished from those that inhibit DNA synthesis but do not damage DNA by examining the change in rate of DNA synthesis during the first 0.5 to 1.5 hr after removal of the suspected agent from the medium in which the cells have been exposed.

13192 **Measurement of sister chromatid exchange in mammalian cells.** Wolff, S. (Univ. of California, San Francisco). pp 575-586 of DNA repair: a laboratory manual of research procedures. Volume 1. Part B. Friedberg, E.C.; Hanawalt, P.C. (eds.). New York, NY; Marcel Dekker, Inc. (1981).

In all the techniques described, the aim is to prepare cells with chromosomes containing sister chromatids that are chemically different from one another, to make slides with large numbers of such cells that are properly spread, and to stain these cells well. The last step requires the exposure of the cells to light in all of the techniques (even those in which Giemsa is used alone). Each cell line or strain will require some special handling for optimal staining, and there will even be day-to-day variation in the quality of the slides obtained by a fixed regimen. The techniques outlined in this chapter can give excellent results with but little fine tuning for minor differences in various laboratories.

13193 **Z-DNA conformation of N-2-acetylaminofluorene modified poly(dG-dC).poly(dG-dC) determined by reactivity with anti cytidine antibodies and minimized potential energy calculations.** Santella, R.M.; Grunberger, D.; Broyde, S.; Hingerty, B.E. (Columbia Univ., New York, NY). *Nucleic Acids Research;* 9: No. 20, 5459-5467(1981). Contract AC02-81ER60015.

The conformation of poly(dG-dC).poly(dG-dC), poly(dG).poly(dC), and calf thymus DNA modified with N-acetoxy-N-2-acetylaminofluorene (N-acetoxy-AAF) was examined by extent of reaction with anti cytidine antibodies. In contrast to modified poly(dG).poly(dC) and DNA, modified poly(dG-dC).poly(dG-dC) failed to react with the antibodies indicating that the base pairing in this polymer is intact. This is consistent with induction of the Z-DNA conformation in AAF modified poly(dG-dC)poly(dG-dC). Using minimized potential energy calculations on the dCpdG-AAF dimer as a model for the modified polymer, it is shown that the proposed Z-DNA conformation is energetically stable. A model is proposed for an AAF modified tetramer, dGpdCpdGpdC, in which the AAF is external to the Z-DNA duplex.

5604 Other Environmental Pollutant Effects

13194 **(PNL—3258) Biological effects of high-strength electric fields on small laboratory animals. Interim report, March 1, 1978-September 30, 1979.** Phillips, R.D.; Anderson, L.E.; Kaune, W.T. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1979. Contract AC06-76RL01830. 337p. NTIS, PC A15/MF A01. Order Number DE83000096.

Portions of document are illegible.

Progress is described on a project assessing the biological effects of 60-Hz electric fields on small laboratory animals (rats and mice). The report includes sections on hematology and seram chemistry, immunology, pathology, metabolism, bone growth, endocrinology, cardiovascular function, neurophysiology, growth and development, and animal behavior. (ACR)

13195 **Health implications of exposure to radiofrequency/microwave energies.** Michaelson, S.M. (Univ. of Rochester, NY). *British Journal of Industrial Medicine;* 39: 105-119(1982).

The rapid development of and the increase in the number and variety of devices that emit microwave/radiofrequency (MW/RF) energies has resulted in a growing interest regarding the potential effects on health of these energies. The frequency ranges considered in this review are: 300 kHz to 300 MHz (radiofrequency) and 300 MHz to 300 GHz (microwaves). Investigations have shown that exposure to certain power densities for several minutes or hours can result in pathophysiological manifestations in laboratory animals. Such effects may or may not be characterized by a measureable rise in temperature, which is a function of thermal regulatory processes and active adaptation by the animal. The end result is either a reversible or irreversible change, depending on the irradiation conditions and the physiological state of the animal. At lower power densities, evidence of pathological changes or physiological alteration is non-existent or equivocal. Much discussion, nevertheless, has taken place on the relative importance of thermal or non-thermal effects of radiofrequency and microwave radiation. Several retrospective studies have been done on human populations exposed or believed to have been exposed to MW/RF energies. Those performed in the US have not shown any relationship of altered morbidity or mortality to MW/RF exposure. Reactions referrable to the central nervous system and cardiovascular effects from exposure of man to microwave energy have been reported mostly in Eastern European publications. Individuals suffering from various ailments or psychological factors may exhibit the same dysfunctions of the central nervous and cardiovascular systems as those reported to result from exposure to MW/RF; thus it is extremely difficult, if not impossible, to rule out other factors in attempting to relate MW/RF exposure to clinical conditions.

57 HEALTH AND SAFETY

13196 **(UCRL—53345) Joint research and development on toxic-material emergency response between ENEA and LLNL. 1982 progress report.** Gudiksen, P.; Lange, R.; Dickerson, M.; Sullivan, T.; Rosen, L.; Walker, H.; Boeri, G.B.; Caracciolo, R.; Fiorenza, R. (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 17p. NTIS, PC A02/MF A01. Order Number DE83002218.

A summary is presented of current and future cooperative studies between ENEA and LLNL researchers designed to develop improved real-time emergency response capabilities for assessing the environmental consequences resulting from an accidental release of toxic materials into the atmosphere. These studies include development and evaluation of atmospheric transport and dispersion models, interfacing of data processing and communications systems, supporting meteorological field experiments, and integration of radiological measurements and model results into real-time assessments.

58 GEOSCIENCES

REFER ALSO TO CITATION(S) 12818

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 11791, 11817, 11826, 11898, 11905, 11916, 11918, 11926, 12251

13197 **(ORNL—5695/Pt.1) Tracer theory with applications in geosciences. Environmental Sciences Division, Publication No. 1964.** Nir, A.; Kirk, B.L. (Oak Ridge National Lab., TN (USA)). Nov 1982. Contract W-7405-ENG-26. 96p. NTIS, PC A05/MF A01. Order Number DE83004174.

The theory of tracer use with specific applications to geosciences is presented in two parts, dealing with systems in the steady and non-steady states, respectively. Part I, presented here, introduces the general concepts of definitions of ideal tracer, common to many disciplines e.g., life sciences, chemical engineering and environmental studies. While generally tracer literature emphasized systems composed of mixed compartments and steady state mass flow, this presentation considers both as singular cases in a non-steady state continuous mass flow system. Specific concepts of tracer theory introduced in Part I are: system response functions h/sup m/(tau) for bulk matter, and h/sup c/(tau) for tracer, 3 parallel time scales: chronological, transit time and age, with separate mass distributions with respect to transit time and age. Part I has five chapters: chapters 1 and 2 introduce the general concepts in a heuristic manner. Chapter 3 introduces two elementary mathematical and statistical tools. Chapter 4 presents the formal statements of tracer theory in the steady state while chapter 5 provides examples of applications.

13198 **Recent trends in hydrogeology.** Narasimhan, T.N. (ed.). Boulder, CO; Geological Society of America, Inc. (1982). 438p. (CONF-790284—). Geological Society of America, Inc., P.O. Box 9140, 3300 Penrose Place, Boulder, CO 80301. Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

Separate abstracts were prepared for sixteen papers. (MHR)

13199 **Physics of saturated-unsaturated subsurface flow.** Narasimhan, T.N. (Lawrence Berkeley Lab., CA). *Geological Society of America, Special Paper;* No. 189, 3-23(1982). (CONF-790284—). Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

Shallow ground-water systems that communicate with the atmosphere are of great interest in the fields of hydrogeology, soil physics, and geotechnical engineering. Under certain circumstances, such multiphase systems can be approximated as saturated-unsaturated complexes in which the prime focus is the water. In general, saturated-unsaturated porous media are characterized by transient fluid motion in conjunction with deformation and desaturation phenomena. This paper identifies, to the extent of present knowledge, the observable physical parameters that characterize saturated-unsaturated systems, and places the parameters in mutual cause-effect relationships. The adequacy of the conceptual framework for studying field problems is examined.

13200 **Contaminant migration in saturated unconsolidated geologic deposits.** Gillham, R.W.; Cherry, J.A. (Univ. of Waterloo, Ontario). *Geological Society of America, Special Paper;* No. 189, 31-62(1982). (CONF-790284—).

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

This paper presents a brief review of the theory of solute migration through porous, nonindurated geologic deposits and examines the laboratory and field evidence upon which transport concepts are currently based. Existing predictive models are considered in relation to the recognized transport processes, including molecular diffusion, mechanical dispersion, and some types of chemical interactions.

13201 **Conceptual aspects of subsidence due to fluid withdrawal.** Helm, D.C. (Lawrence Livermore Lab., CA). *Geological Society of America, Special Paper;* No. 189, 102-139(1982). (CONF-790284—). Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

A saturated reservoir or confined aquifer system responds to fluid withdrawal as a dynamic unit whose elemental volumes not

only compress due to decrease in porosity but move horizontally and vertically in order for the system to remain contiguous. Recent trends in the conceptual aspects of subsidence due to fluid withdrawal are toward developing a practical three-dimensional theory of reservoir theory is to couple volume strain within a reservoir to calculated stress change. An alternative approach to developing a three-dimensional theory is proposed here. It couples reservoir velocity fields in three dimensions to appropriate force fields. The generally neglected effect of the gravitational force field on transient movement of solids is included in the analysis. After calculating the transient velocity field of a saturated granular medium, it is conceptually possible to estimate the displacement of solids by integrating velocity over an appropriate interval of time.

13202 **Physical properties of porous geologic materials.** Houston, W.N. (Univ. of California, Berkeley); Kasim, A.G. *Geological Society of America, Special Paper;* No. 189, 143-162(1982). (CONF-790284—).

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

Porosity, permeability, and moduli are the properties most fundamental to assessing skeletal deformations and water flow rates in porous materials. For saturated materials, these properties are similar for both soft and stiff material skeletons, but greatly simplified models can be used when the skeleton is relatively soft. The effective stress is a key parameter for both soft and stiff materials when saturation is complete, but is much less powerful for partially saturated materials. Ideally, the needed properties of porous materials should be determined from an integrated program of laboratory testing, field testing, and solution of the inverse problem using a numerical method capable of modeling the boundary conditions used in the field tests. Where such a large-scale program is impractical, properties can be estimated from extensive laboratory testing and from the typical values suggested herein.

13203 **Assessing the permeability characteristics of fractured rock.** Gale, J.E. (Univ. of Waterloo, Ontario). *Geological Society of America, Special Paper;* No. 189, 163-181(1982). (CONF-790284—).

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

The geometric and hydraulic characteristics of fractures and fractured rock masses are reviewed to assess the current state and future direction of fracture hydrology research. Laboratory data suggest that the parallel-plate analogy for flow through a single fracture is valid. Fracture-flux is a function of the cube of the fracture aperture. Flow through fractures is a function of normal stress, shear stress, and fracture surface characteristics such as roughness. Flow through fractured rock masses is determined by fracture orientation, spacing, fracture interconnection, and the stress field. These factors must be considered in assessing the directional permeabilities of fractured rocks. Consideration of these factors and the structural characteristics of fractured rock leads to the formulation of a conceptual framework for flow in fractured rock masses that is a form of coupled discrete-fractured porous media model. In this conceptual framework, the shear zones and fracture zones are described as discrete hydrogeologic features; individual fractures (joints) are defined as discrete features near zones of interest, such as underground excavations; and the fractured rock mass in general is described as a form of equivalent fractured porous medium. It is proposed that the properties of the equivalent continuous porous medium must be developed from discrete fracture properties, reflecting the dependence of fracture permeability on the stress tensor, fracture geometry, distribution of fracture apertures, and degree of fracture interconnection.

13204 **Flow-test evaluation of fractured reservoirs.** Gringarten, A.C. (FLOPETROL, Melun Cedex, France). *Geological Society of America, Special Paper;* No. 189, 237-263(1982). (CONF-790284—).

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

Available methods for interpreting flow tests in fissured formations are summarized. The methods are taken from the geotechnical, groundwater, and petroleum literature. These are usually based on equivalent reservoir solutions, which attempt to relate the actual fissured reservoir behavior to that of a known theoretical model, homogeneous or heterogeneous, of lower complexity. The double-porosity concept, used by many authors for ground-water and petroleum engineering problems, is critically reviewed and the relationship between the various available solutions is established. The methods presented are illustrated with well-test data from aquifers and oil reservoirs of various characteristics.

13205 **Numerical modeling in hydrology.** Narasimhan, T.N. (Lawrence Berkeley Lab., CA). *Geological Society of America, Special Paper;* No. 189, 273-293(1982). (CONF-790284—). Contract W-7405-ENG-48.

From Symposium on recent trends in hydrogeology; Berkeley, CA, USA (8 Feb 1979).

The equation governing isothermal flow of water in deformable media is one of mass conservation. For an appropriately small volume element satisfying certain averaging criteria, the conservation equation helps convert the rate of accumulation of mass to an equivalent, average time-derivative of the potential function. The goal of numerical modeling is to evaluate the rate of mass accumulation in the volume element by integration in space and time. In order to carry out the integration, the flow region has to be partitioned and spatial gradients of potential evaluated. Depending on the procedure by which spatial partitioning is achieved and on the manner in which potential gradients are evaluated, different numerical schemes such as the integral finite difference method and the finite element method arise. These methods can lead to a set of either explicit or implicit discretized equations. In setting up the equations, time-dependent coefficients may be handled in either a quasi-linear or an iterative fashion. The final set of implicit equations, giving rise to a sparse coefficient matrix, may be handled through direct solvers or through iterative solvers. Numerical models may be validated with the help of analytic solutions to partial differential equations or with experimental data. Based on set-theoretic concepts, it is reasoned that numerical models possess far greater generality than merely providing analytic solutions to the partial differential equation. To derive the real benefit of numerical models, therefore,techniques should be developed to validate numerical solutions based on their axiomatic foundations, rather than relying upon analytic solutions. Although our current computing abilities transcend our ability to generate sophisticated field data, there is considerable scope for further research on numerical methods.

5802 Geophysics

REFER ALSO TO CITATION(S) 11816, 11839, 11840, 11841, 11842, 11906, 12854, 13017, 13060

13206 **(DOE/ER/12017—4) Observations of volcanic tremor at Mt. St. Helens volcano.** Fehler, M. (Oregon State Univ., Corvallis (USA). School of Oceanography). 25 Jun 1982. Contract AT06-82ER12017. 39p. NTIS, PC A03/MF A01. Order Number DE83004902.

Digital recordings of ground motion during tremor episodes accompanying eruptions at Mt. St. Helens Volcano in the state of Washington on August 7 and October 16-18, 1980 are studied. The spectra of the vertical component waveforms contain at least two dominant peaks at 1.0 and 1.3 Hz for all events recorded during both eruptions that were studied. Spectra of horizontal ground motion show peaks at .9 and 1.1 Hz. the relative amplitudes of the two peaks changes between tremor episodes and during single tremor episodes and show no consistent relation to amplitude of ground motion. Spectra of long period earthquakes are very similar to those of tremor events suggesting that tremor is composed of many long period earthquakes that occur over a period of time. The path effect of tremor waveforms is small since there are no peaks in the spectra of waveforms recorded during tectonic earthquakes occurring in the vicinity of Mt. St. Helens. Amplitudes of ground motion varies between .11 μm and 4.7 μm. Seismic moment rates during the two eruptions are calculated using the model of Aki et al. (1977) and found to vary between 6×10^{18} and 1×10^{20} dynes cm sec^{-1} which are larger than values found by Aki et al. (1977) who studied amplitudes of shallow tremor events recorded during the October, 1963 eruption of Kilauea volcano in Hawaii. Study of tremor amplitudes recorded at Corvallis, Oregon leads to

the conclusion that tremor accompanying the cataclysmic May 18, 1980 eruption was at least one order of magnitude larger in amplitude than tremor during August and October.

13207 **(DOE/ID/12044—T1) Faults and lineaments of the Southern Cascades, Oregon. Special paper No. 13.** Kienle, C.F.; Nelson, C.A.; Lawrence, R.D. (Foundation Sciences, Inc., Portland, OR (USA)). 1981. Contract FC07-79ID12044. 44p. NTIS, PC A03/MF A01. Order Number DE83004447.

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The objective was to construct a fault and lineament map of the Southern Cascades, from 121° 30'W to 123°W longitude, and 42°N to 43° 45'N latitude, based on interpretive study of the available high- and low-level imagery. This map includes previously known and inferred faults, and identifies several extensions of known faults, several faults newly inferred during this study, and lineaments of unknown but probable structural origin. This report and accompanying map describe imagery types used, procedures used in interpreting the imagery, criteria used to identify lineaments, and the geologic influences in expression of lineaments and faults. Included is a brief tectonic interpretation of faults and lineaments in the study area.

13208 **(DOE/ID/12044—T2) Geological linears of the northern part of the Cascade Range, Oregon. Special paper No. 12.** Venkatakrishnan, R.; Bond, J.G.; Kauffman, J.D. (Geoscience Research Consultants, Moscow, ID (USA)). 1980. Contract FC07-79ID12044. 73p. NTIS, PC A03/MF A01. Order Number DE83004312.

The primary objective of this work is to provide linears maps which may be used to identify unmapped faults, to allow extension of known faults and to define structural patterns in the vicinity of the Cascade Range. The scope of the study is confined primarily to identifying geologic linears within the area and to presenting their location and orientation in a systematic format. Preliminary interpretive observations are included as a basis for further discussion.

13209 **(EGG-PHYS—6145) Earthquake catalog for the eastern Snake River Plain region, Idaho (43.0°-44.5°N, 111.5°-114.0°W), October 1972-June 1982.** King, J.J.; Doyle, T.E. (Idaho National Engineering Lab., Idaho Falls (USA)). Dec 1982. Contract AC07-76ID01570. 50p. NTIS, PC A03/MF A01. Order Number DE83005014.

Portions of document are illegible.

The Idaho National Engineering Laboratory (INEL) has deployed a network of short-period high-gain vertical seismographs since December 1971 to monitor earthquake activity on and about the eastern Snake River Plain (ESRP), Idaho. This report summarizes the earthquakes located within a designated Special Study Area (43.0° - 44.5°N, 111.5° - 114.0°W) from October 1972 to June 1982. Seventy-eight events were located within the Special Study Area, with a richter Local Magnitude (M/sub L/) range of 0.8 ≦ M/sub L/ ≦ 2.7. The mean M/sub L/ for these microearthquakes was 1.4. Only three small microearthquakes (M/sub > ~ 1.0) were detected on the ESRP. Fifty-nine microearthquakes were located northwest of the ESRP, primarily in the Birch Creek Valley - Beaverhead Range region. Sixteen microearthquakes were located southeast of the ESRP within the Special Study Area. The aseismicity within the ESRP can possibly be attributed to high crustal heat flow which alloys aseismic creep to occur in response to regional tectonic forces, rather than earthquakes. The aseismic behavior of the Lost River, Lemhi, and Beaverhead Ranges northwest of the ESRP may also be associated with aseismic creep or possibly small strain accumulation rates. The very low seismic activity reported in this study is in agreement with the historical record of seismicity compiled for the ESRP region.

13210 **(NUREG/CR—2995) Canadian seismic agreement. Annual report, 1 July 1981 to 30 June 1982.** Lyons, J.A.; Wetmiller, R.J.; Andersen, F.; Drysdale, J.A.; Shannon, W.E.; Hayman, R.B.; Basham, P.W. (Canadian Commercial Corp., Ottawa, Ontario). Nov 1982. 32p. NTIS, PC A03/MF A01 - GPO $4.50. Order Number DE83900851.

Activities undertaken by the Earth Physics Branch (EPB) during the past year are described. Data concentrators were established at Hauterive and Riviere-du-Loup in Quebec and St. John in New Brunswick to handle new stations in eastern Quebec and the Maritimes. Six new stations have been installed at Hauterive and Grosses-Roches, Quebec and Edmunston, Caledonia Mountain, St. George and Mount McKendrick, New Brunswick. Network developments are outlined. A more sophisticated version of the multiplexing outstation software developed under contract and currently being tested is outlined. Version 1 of the Seismic Analysis Monitor (SAM) software package (formerly DISDAP) has just gone into production. A summary of the performance of ECTN over the past year is given. A summary of eastern Canadian seismicity during the reporting period is included.

13211 **(NUREG/CR—3021) Regional tectonics and seismicity of southwestern Iowa. Final report, 1978-1982.** Van Eck, O.J.; Anderson, R.R.; Cumerlato, C.L.; Faller, T.H.; Logel, J.D. (Iowa Geological Survey, Iowa City (USA)). Nov 1982. 68p. NTIS, PC A04/MF A01 - GPO $5.00. Order Number DE83900978.

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Utilizing gravity and aeromagnetic data, a series of geophysical profiles were constructed across the Midcontinent Geophysical Anomaly (MGA) which extends across the southwestern Iowa study area. By combining the information provided by modeling techniques with limited deep well data, a map of the Precambrian basement was generated. The interpretation that emerged includes a central horst of igneous intrusives and extrusives, extensively faulted, and overlain in some areas by Keweenawan clastics. The horst is flanked by a series of high angle faults, with the majority of the faults displaying vertical displacement along two structural zones, the Thurman-Redfield Structural Zone, along which flanks the northwestern boundary. The total vertical displacement present along these fault zones is estimated to be a maximum of 9 km. Two clastic-filled basins flank the horst, one of which has an interpreted depth of 10 km. Seismic profiling indicates rather extensive folding and faulting of Paleozoic rock units, although the scale of deformation is minor when compared to Precambrian features in the same area. Although the Paleozoic Era was the most tectonically active of the post-Precambrian eras there are indications of post-Cretaceous movement. Recent tectonic activity is suggested by the numerous microearthquakes that were recorded by the monitoring array that was installed for this study.

13212 **(NUREG/CR—3102) Effects of earthquake-rupture shallowness and local soil conditions on simulated ground motions.** Apsel, R.J.; Hadley, D.M.; Hart, R.S. (Lawrence Livermore National Lab., CA (USA)). Dec 1982. Contract W-7405-ENG-48. 134p. (UCRL—15495). NTIS, PC A07/MF A01 - GPO. Order Number DE83004210.

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In order to develop site-specific response spectra from strong ground motion recordings appropriate for Eastern United States (EUS) sites, it is necessary to perform extrapolations from response spectra appropriate in other areas due to the scarcity of strong ground motion recordings available in the EUS. Recordings obtained from the more abundant Western United States (WUS) database are typically chosen to perform these extrapolations. The extrapolations require knowledge of how differences in tectonic and geologic conditions between EUS and WUS translate into differences in recorded ground motions. One of the most widely accepted tectonic differences between EUS and WUS is the observed depth of earthquake rupture for magnitudes 4 and greater. This report documents, using sophisticated three-dimensional numerical modeling techniques, how spectral shapes extrapolated from the WUS database must be scaled to account for differences in earthquake rupture shallowness. Using sophisticated three-dimensional numerical modeling techniques, the potential ground motions from small shallow events are estimated and the spectral shapes compared to those calculated for larger magnitude earthquakes occurring at more typical depths in the EUS. The possible effects of local soil conditions on the seismic response spectra are demonstrated. Earthquake ruptures of various magnitudes, site distances and fault types are compared as a function of rupture shallowness for a generic rock site and a generic soil site and do not include the possible effects of site-specific soil properties present in the upper fifty meters. Comparisons are also made among four earth models to

demonstrate the effects of local soil conditions on the calculated response spectra.

13213 (SAND—82-1711C) Wellborne inertial navigation system. Kelsey, J.R. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 23p. (CONF-830203—2). NTIS, PC A02/MF A01. Order Number DE83004012.

From IADC/SPE drilling conference; New Orleans, LA, USA (20 Feb 1983).

A phototype wireline tool which includes a downhole inertial platform and a surface computer to spatially map a well is described. The hardware consists of a single-gimbaled inertial platform with accelerometers and gyros to obtain three-axis motion information. The gyroscope and accelerometer outputs are transmitted to a computer at the surface which calculates probe attitude relative to north, east, and vertical. Double integration of the accelerometer data provides the position information. A conventional 7-conductor wireline is used for the system data transmission. System accuracy is enhanced by advances made in the computer software which processes the data received from the tool. The software uses statistical sampling estimation to obtain optimal estimates of the system errors. Measurement errors are determined by periodically stopping the tool during the logging procedure and observing the indicated velocity measurements. This procedure, known as Kalman filtering, results in increased accuracy of the data. Present mapping systems have an X-Y-Z location accuracy of +- 100 to +- 200 feet for a typical well depth of 10,000 feet. Test results show that the new system is accurate to about +- 1 foot per 1000 feet of well depth. Unlike conventional systems, the inertial navigator does not require any sort of projection of the cable length (which may not be accurately known). Also this system provides continuous data throughout the wellbore and logging speeds on the order of 10 ft/sec appear possible. The hardware and software associated with this mapping system are described and the recent field test results are reported.

13214 (USGS-OFR—82-478) Reconnaissance seismic refraction studies at Calico Hills, Wahmonie, and Yucca Mountain: southwest Nevada Test Site, Nye County, Nevada. Pankratz, L.W. (Geological Survey, Denver, CO (USA)). 1982. Contract AI08-78ET44802. 27p. NTIS, PC A03/MF A01. Order Number DE83005619.

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Reconnaissance refraction surveys consisting of a total 5 spreads were conducted in the Calico Hills, Wahmonie, and Yucca Mountain areas, southwestern Nevada Test Site (NTS). Data from Calico Hills and Wahmonie are generally high in quality; data from Yucca Mountain are for the most part low in quality. At Calico Hills and Wahmonie, special attention was focused on the possible occurrence of a major intrusive body at depth. At Calico Hills this occurrence is supported by an inferred dome-shaped velocity interface, possibly associated with the roof of an altered phase of argillite. however, if an intrusive body is present, its top must be buried deeper than 3 km or it must be so pervasively altered that its velocity is similar to that of the calcareous argillite encountered at the bottom of drill hole UE 25a-3. At Wahmonie, the seismic data suggest the occurrence of a massive lenticular unit within 60 m of the ground surface, probably consisting of argillite but possibly consisting of intensively altered intrusive rock. At Yucca Mountain, preliminary interpretations of the most reliable data suggest the occurrence of a major, steeply inclined velocity interface 500 m from the southwest end of the Yucca C spread. This interface may represent a major fault or erosional feature separating the Topopah Spring and Tiva Canyon Members with Paintbrush Tuff at depth. This interface is 800 m east of a previously mapped fault. On the basis of poor-quality data obtained at Yucca Mountain, the subsurface velocity distribution appears to be complex. For example, one spread near drill hole UE25 a-1 suggests not only a much thicker section of Tiva but also that this material is down thrown in the valley. This may suggest faulting with throws exceeding 100 meters or an equivalent erosional feature.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 11854, 11924

13215 (BM-RI—8451) Thermodynamic proprties of petalite ($Li_2Al_2Si_8O_{20}$). Bennington, K.O.; Stuve, J.M.; Ferrante, M.J. (Bureau of Mines, Washington, DC (USA)). 1978. 23p. Bureau of Mines, Washington, DC.

The thermodynamic properties of petalite ($Li_2Al_2Si_8O_{20}$) were determined by the Bureau of Mines. The enthalpy of formation was determined by hydrofluoric acid solution calorimetry. The values from the elements and from the oxides are $\Delta H/sub\ f/°_{298.15}$ = 2335.8 +- 3.0 kcal/mol and $\Delta H°_{298}$ (from oxides) = -50.60 +- 1.20 kcal/mole. Low-temperature heat capacities were determined by adiabatic calorimetry from 10.69 to 302.11 K. The derived standard entropy is $S°_{298.15}$ = 111.0 +- 1 cal/deg-mole. Enthalpy increments above 298 K were measured by copper block calorimetry from 298 K to 1193.6 K. The various experimental data were combined with other data from the literature to calculate the Gibbs energies of formation and equilibrium constants of formation over the temperature range of the measurements. Tables of enthalpies of formation and Gibbs energies of formation are given as a function of temperature from the elements and constituent oxides. The Gibbs energy of formation is $\Delta G°/sub\ f/_{298.15}$ = 2203.8 kcal/mole.

13216 (BNL—32210) Thermoluminescence of the mineral components in granite. Schwartzman, R.G.; Kierstead, J.A.; Levy, P.W. (State Univ. of New York, Stony Brook (USA); Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 21p. (CONF-820764—1). NTIS, PC A02/MF A01. Order Number DE83003929.

From 3. international seminar on thermoluminescence and ESR dating; Elsinore, Denmark (1 Jul 1982).

The thermoluminescence (TL) of the minerals in Climax Stock (Nevada, USA) granite has been studied. The principal mineral constituents are plagioclase, quartz, potassium feldspar and biotite. Pyrite, sphene apatite and zircon occur at one percent or less. All exhibit TL except biotite. The TL kinetics were determined for plagioclase, quartz, potassium feldspar and pyrite. Plagioclase and potassium feldspar exhibit second order and pyrite first orker kinetics. Natural TL of quartz follows second order and artificial TL first order kinetics. However, in these four minerals unrealistic kinetic parameters are often obtained; thus more general kinetics, e.g. interactive kinetics, may apply. 8 figures.

13217 (DOE/ER/10361—3-3A) Deformation mechanisms in granodiorite at effective pressures to 100 MPa and temperatures to partial melting. Friedman, M.; Handin, J.; Bauer, S.J. (Texas A and M Univ., College Station (USA). Center for Tectonophysics). 1981. Contract AS05-79ER10361. 11p. (CONF-820803—16). NTIS, PC A02/MF A01. Order Number DE83003764.

From 23. US symposium on rock mechanics; Berkeley, CA, USA (25 Aug 1982).

Deformation mechanisms in room-dry and water-saturated specimens of Charcoal Granodiorite, shortened at $10^{-4}s^{-1}$, at effective pressures (Pe) to 100 MPa and temperatures to partial melting ($\leq$ 1050°C) are documented with a view toward providing criteria to recognize and characterize the deformation for geological and engienering applications. Above 800°C strength decreases dramatically at effective pressures $\geq$ 50 MPa and water-weakening reduces strength an additional 30 to 40% at Pe = 100 MPa. Strains at failure are only 0.1 to 2.2% with macroscopic ductility (within this range) increasing as the effective pressures are increased and in wet versus dry tests. Shattering (multiple faulting) gives way to faulting along a single zone to failure without macroscopic faulting as ductility increases. Microscopically, cataclasis (extension microfracturing and thermal cracking with rigid-body motions) predominates at all conditions. Dislocation gliding contributes little to the strain. Precursive extension microfractures coalesce to produce the throughgoing faults with gouge zones exhibiting possible Riedel shears. Incipient melting, particularly in wet tests, produces a distinctive texture along feldspar grain boundaries that suggests a grain-boundary-softening effect contributes to the weakening. In addition, it is demonstrated that the presence of water does not lead

to more microfractures, but to a reduction in the stresses required to initiate and propagate them.

13218 **(LA-UR—82-3641) Origin of a sanidine-coesite grospydite.** Wohletz, K.H.; Smyth, J.R. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 24p. (CONF-820992—1). NTIS, PC A02/MF A01. Order Number DE83004742.

From 3. international kimberlite conference; Clermont-Ferrand, France (8 Sep 1982).

Portions of document are illegible.

A grospydite xenolith from the Roberts Victor kimberlite pipe in South Africa presents an unusual phase assemblage of clinopyroxene, garnet, kyanite, coesite, and sanidine. The rock as previously described (Smyth and Hatton, 1977) consists of 50% omphocitic clinopyroxene, 28% garnet ($Gr_{50}Py_{28}Alm_{22}$), 9% kyanite, 65 coesite, and 1% sanidine (Or_{99}). Assuming the addition of three additional compatible phases (phlogopite, enstatite, and H_2O vapor) and a simplified chemistry of the phases present, a Schreinemakers thermodynamic analysis was attempted in order to estimate the pressure and temperature of equilibrium of the rock. Four reactions involving six components are likely to have determined an invariant point for the assemblage: (1) Kyn + 2 Cpx reversible Cos + Gt + En; (2) 3 Cos + Phl reversible San + 3 En + H_2O; (3) 3 Kyn + 6 Cpx + Phl reversible San + 3 Gt + 6 En + H_2O; and (4) 6 Cos + 3 gt + Phl reversible San + 3 Kyn + 6 Cpx + H_2O. Using tabulated as well as estimated thermodynamic data for the phases, the calculated values for equilibrium temperatures and pressures for the reactions yield an invariant point for the assemblage at a depth of about 160 km (40 kbars) and a temperature of about 1060°C. This point likely represents a subsolidus recrystallization stage of origin.

13219 **(SAND—82-1314) Uniaxial and triaxial compression test series on Calico Hills tuff.** Price, R.H.; Jones, A.K. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 36p. NTIS, PC A03/MF A01. Order Number DE83003769.

Forty-four uniaxial and triaxial compression experiments were performed on samples of the Tuffaceous beds of Calico Hills obtained from drill hole USW-G1 at Yucca Mountain on the Nevada Test Site. Water saturated and room dry test specimens were deformed at nominal strain rates of 10^{-3}, 10^{-5} and 10^{-7} s^{-1}; confining pressures of 0.1, 10 and 20 MPa; and room temperature. Resultant unconfined compressive strengths, axial strains to failure, Young's moduli and Poisson's ratios ranged from 14.2 to 42.0 MPa, 0.0037 to 0.0087, 2.52 to 9.72 GPA and 0.17 to 0.37, respectively.

13220 **(SAND—82-2187C) Engineering model for predicting rubble motion during blasting.** Schamaun, J.T. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 25p. (CONF-830115—1). NTIS, PC A02/MF A01. Order Number DE83005007.

From 9. annual conference on explosives and blasting techniques; Dallas, TX, USA (31 Jan 1983).

Recent applications of explosives and blasting agents to rubble rock have led to requirements for more elaborate design and analysis methods. In most blasting uses, it is necessary not only to fracture the rock, but also to move the broken rubble in a predictable manner. Many in-situ extraction techniques require rubblization to take place in a confined region where rock motion is a predominate factor in creating a permeable broken bed. In this paper, an engineering model is presented which describes the large rubble motion during blasting. This model is intended to provide the blast designer with a tool for evaluation and further refinement of blasting patterns and timing sequences. In this model the rock medium is represented by a discrete series of circular regions of fractured material. These regions are set in motion by pressure loads from the explosive. The motion of the regions is calculated using a step-wise, explicit, numerical time integration method. Interaction of adjacent regions is based on inelastic impact of spherical bodies. The derivation of this model is presented along with the background for selecting loading pressure based on explosive behavior. Three typical examples, including both cratering and bench geometries, are discussed which illustrate the use of this model to predict rubble motion. This engineering representation appears to provide a practical model for use in predicting rubble motion and a tool for design evaluation of blasting in confined geometries. 15 figures.

13221 **(UCRL—87217) Measurement of thermal diffusivity of rocks at high pressure.** Mirkovich, V.V.; Durham, W.B.; Heard, H.C. (Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Canada Centre for Mineral and Energy Technology; Lawrence Livermore National Lab., CA (USA)). Oct 1982. Contract W-7405-ENG-48. 19p. (CONF-820985—2). NTIS, PC A02/MF A01. Order Number DE83003879.

From 8. European conference on thermophysical properties - high temperatures high pressure; Baden-Baden, F.R. Germany (27 Sep 1982).

A method for measurement of thermal diffusivity at high hydrostatic pressure was developed by adapting a radial symmetry heat flow method wherein a sinusoidal heat wave is applied to the cylindrical surface of the sample. The accuracy of the measuring system was tested using Pyroceram 9606. Data obtained were within 5% of published values at all temperatures to 400°C and no dependence upon pressure was observed. Thermal diffusivity of three crystalline igneous rock specimens was measured at temperatures from 32 to 400°C and pressures from 0.1 to 200 MPa. The results for Creighton quartz diorite showed only limited temperature and pressure dependence. In the case of Stripa and Westerly granites, this dependence was found to be more substantial. Thermal diffusivity of Stripa granite decreased by more than 50% from 32 to 400°C and that of Westerly granite decreased by approximately 40% over the same range. At 32°C and 200 MPa, thermal diffusivity for both rocks was higher by approximately 10% than that measured at 0.1 MPa. At higher temperatures the difference in thermal diffusivity between the two pressure levels increased. An anomaly was observed in Stripa and Westerly granite in the temperature range 32 to 65°C: thermal diffusivity increased with increasing temperature. The anomaly is consistent with recently observed thermal expansivity in these rocks as a function of pressure and temperature.

13222 **Calorimetric evidence for ideal mixing of silicon and germanium in glasses and crystals of sodium feldspar composition.** Capobianco, C.; Navrotsky, A. (Arizona State Univ., Tempe). *American Mineralogist;* **67**: No. 7-8, 718-724(Jul 1982). Contract AC02-80ER10765.

High temperature oxide melt solution calorimetric data have been obtained for glasses and crystals of sodium feldspar composition, NaAl (Si, Ge)$_3$O$_8$, with varying degrees of substitution of Ge for Si. A linear dependence on composition for the enthalpies of solution implies ideal mixing behavior for both crystalline and glassy phases. The results are discussed in light of the rather different reported viscosities for end-member melts. The thermodynamic data collected allow calculation of a simple phase diagram for this two-component system. The calculated value of K/sub D/ = (X/sub Ge/sup c//X/sub Si//sup c/)/(X/sub Ge//sup l//X/sub Si//sup l/) is 0.87 +/- 0.05.

5804 Geochemistry

REFER ALSO TO CITATION(S) 11830, 11831, 11832, 11833, 11834, 11835, 11836, 11837, 11915, 11925, 12254, 13197, 13233

5805 Oceanography

REFER ALSO TO CITATION(S) 11907

64 PHYSICS RESEARCH

13223 **(INIS-mf—7220) Sixth conference of Czechoslovak physicists. Part 1. Vol. 2.** (Jednota Ceskoslovenskych Matematiku a Fyziku, Ostrava). [nd]. 36p. (In Czech). (CONF-7908174—Pt.1Vol.2). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83780084.

From 6. conference of Czechoslovak physicists; Ostrava, Czechoslovakia (27 Aug 1979).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

13224 **(INIS-mf—7221) Sixth conference of Czechoslovak physicists. Part 2.** (Jednota Ceskoslovenskych Matematiku a Fyziku, Ostrava). [nd]. 89p. (In Czech). (CONF-7908174—Pt.2). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780081.

From 6. conference of Czechoslovak physicists; Ostrava, Czechoslovakia (27 Aug 1979).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

13225 **(INIS-mf—7432) Sixth conference of Czechoslovak physicists. Part 1. Volume 1.** Kapoun, K. (ed.). (Jednota Ceskoslovenskych Matematiku a Fyziku, Ostrava). [nd]. 119p. (In Czech). (CONF-7908174—Pt.1Vol.1Summ). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83780216.

From 6. conference of Czechoslovak physicists; Ostrava, Czechoslovakia (27 Aug 1979).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

13226 **(NP—3900856) Annual report, 1981. Cosmic and subatomic physics, elementary particle physics, mathematical physics, and theoretical high energy physics.** (Lund Univ. (Sweden)). Jan 1982. 116p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83900856.

Portions of document are illegible.

This annual report contains contributions from 4 subatomic divisions at the departments of Experimental and Theoretical Physics in Lund. The aim is to give a general impression of the various activities. The divisions are represented in this report. (1) The Division of Cosmic and Subatomic Physics, which belongs to the Faculty of Natural Sciences, are performing experiments in (i) nuclear structure physics, (ii) high energy and particle physics, and (iii) cosmic ray physics. (2) The Division of Elementary Particle Physics, which belongs to the faculty of Natural Sciences, performs experimental particle physics and is mainly involved in projects at CERN in Geneva and DESY in Hamburg. The investigations are concentrated on quark and lepton physics. (3) The Division of Mathematical Physics, which belongs to the Faculty of Technology, consists of two groups. One group is studying theoretical nuclear physics: high spin states, fission and nuclear deformations, and nuclear reactions. Another group is studying problems of classical physics: thermodynamics and energy research projects. (4) The Division of Theoretical High Energy Physics, which belongs to the Faculty of Natural Sciences, studies theoretical high energy physics with special interest in multiparticle production within the quark-parton model framework. In the following the divisions and their activities are presented, and a list of publications and reports is given. (WHK)

6401 Astrophysics And Cosmology

13227 **(DOE/ER/40048—28-L2) ^{7}Be decay scheme and the solar-neutrino problem.** Norman, E.B.; Chupp, T.E.; Lesko, K.T.; Osborne, J.L.; Grant, P.J.; Woodruff, G.L. (Washington Univ., Seattle (USA)). 1982. Contract AC06-81ER40048. 13p. NTIS, PC A02/MF A01. Order Number DE83004916.

The decay scheme of ^{7}Be has been reinvestigated. A known number of ^{7}Be nuclei were produced in a target via the ^{7}Li(p,n) reaction. Following activation, the yield of 478-keV γ-rays from the target was measured. From decay branching ratio to the first excited state of ^{7}Li has been determined to be 10.8 +- 0.4%. The implications of this result for the solar neutrino problem are discussed.

13228 **(DOE/ER/40048—30-L2) Cosmic clocks.** Norman, E.B. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). [nd]. Contract AC06-81ER40048. 11p. NTIS, PC A02/MF A01. Order Number DE83004905.

Portions of document are illegible.

Two techniques based on astronomical observations have been developed which enable the age of the universe to be estimated, and an interdisciplinary field known as nuclear cosmochronology has allowed the ages of the earth and solar system to be determined. (GHT)

13229 **(KFK—3327) Population probabilities of excited states in radioactive nuclei for s-process studies.** Walter, G.; Beer, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Zyklotronlaboratorium). Apr 1982. 105p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE82750930.

The population probabilities of excited states for a series of important unstable nuclei on the s-process path have been calculated as a function of temperature. The data are presented in graphic and tabulated form.

13230 **(LA-UR—82-3578) Non-LTE astrophysics and the origin of high-energy cosmic rays.** Colgate, S.A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 8p. (CONF-820989—2). NTIS, PC A02/MF A01. Order Number DE83004737.

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

Portions of document are illegible.

The most startling aspects of the universe are the departures from the nonuniform, nonthermodynamic equilibrium state. Mass concentrations and high energy electromagnetic quanta and particles are the primary examples. Of these various departures the extremum of nonexplained phenomena is still the acceleration of cosmic rays. The usual explanations involving multiple mechanisms contributing to various regions of the spectrum is suggested as most unlikely. In particular, the suggestion of the acceleration of the very highest energy cosmic rays in distant active galactic nuclei is shown to be untenable because of photon particle interactions.

13231 **(LA-UR—82-3596) Gamma bursts.** Colgate, S.A.; Petschek, A.G. (Los Alamos National Lab., NM (USA)). 9 Dec 1982. Contract W-7405-ENG-36. 6p. (CONF-8210111—2). NTIS, PC A02/MF A01. Order Number DE83004810.

From Numerical astrophysics meeting; Urbana, Israel (21 Oct 1982).

The origin of cosmic gamma bursts is discussed. Radiation thermalization in magnetic fields, spectral mechanisms, and charge separation and photon heating are discussed. (GHT)

13232 **Survival of primordial color fluctuations.** Kolb, E.W. (Los Alamos National Lab., NM (USA). Theoretical Div.); Turner, M.S. (Chicago Univ., IL (USA). Astronomy and Astrophysics Center). *Physics Letters,* [*Section*] *B;* **115**: No. 2, 99-103(26 Aug 1982).

We calculate the probability that primordial statistical color fluctuations present in the early universe survive and become states of fractional electric charge. Even in the case of exact (i.e., perfectly confining) QCD, we show that there may be a nonzero (but undetectably small) abundance of fractionally-charged states due to primordial fluctuations. We predict a larger fractional charge abundance if QCD is broken, and that the abundance would probably be unacceptably large if the temperature for spontaneous symmetry breaking is greater than the QCD scale parameter Λ.

13233 **Solar neutrino production of technetium-97 and technetium-98.** Cowan, G.A. (Los Alamos National Lab., NM); Haxton, W.C. *Science (Washington, D.C.);* **216**: 51-54(2 Apr 1982).

It may be possible to determine the boron-8 solar neutrino flux, averaged over the past several million years, from the concentration of technetium-98 in molybdenite. The mass spectrometry of this system is greatly simplified by the absence of stable technetium isotopes, and the presence of the fission product technetium-99 provides a monitor of uranium-induced backgrounds. This geochemical experiment could provide the first test of nonstandard solar models that suggest a relation between the chlorine-37 solar neutrino puzzle and the recent ice age.

13234 **Organic compounds in meteorites and their origins.** Hayatsu, R. (Argonne National Laboratory, Argonne, IL); Anders, E. (Chicago, University, Chicago, IL). *Topics in Current Chemistry;* 99: 1-37(1981).

The current investigation represents an extensively updated version of a review conducted by Anders et al. (1973). The investigation takes into account the literature through mid-1980. It is pointed out that Type 1 carbonaceous chondrites (C1) contain 6% of their cosmic complement of carbon, mainly in the form of organic matter. Most authors now agree that this material represents primitive prebiotic matter. The principal questions remaining are what abiotic processes formed the organic matter, and to what extent these processes took place in locales other than the solar nebula, such as interstellar clouds or meteorite parent bodes. The problem is approached in three stages. It is attempted to reconstruct the physical conditions during condensation from the clues contained in the inorganic matrix of the meteorite. The condensation behavior of carbon under these conditions is determined on the basis of thermodynamic calculations. Model experiments on the condensation of carbon are performed, and the synthesized compounds are compared with those actually found in meteorites.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 12346, 12347, 12815, 12934, 13251, 13293, 13404

13235 **(DOE/ER/02408—212) Application of the electron-cyclotron resonance source to Lamb-shift polarized ion sources.** Clegg, T.B.; Schmor, P.W.; Jacquot, C.; Delaunay, M.; rocco, J.C.; Geller, R. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics; British Columbia Univ., Vancouver (Canada). TRIUMF Facility; Association Euratom-CEA, Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherches sur la Fusion Controlee; Alberta Univ., Edmonton (Canada). Dept. of Physics). [nd]. Contract AS05-76ER02408. 27p. (ORO—2408-212). NTIS, PC A03/MF A01. Order Number DE83004561.

We describe the application of an electron-cyclotron resonance ion source to a Lamb-shift spin-polarized ion source. Initial experimental tests to measure the H^- and D^- ion current from such a system have not succeeded, probably because of large space-charge fields inside the beam which quenched desired 2S-metastable atoms within the ion source. However, a modified configuration is described which should eliminate these space-charge problems and is expected to yield substantially larger polarized H^- and D^- currents.

13236 **(DOE/ER/02408—213) Theory of Coulomb excitation and ionization.** Merzbacher, E. (North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy). 1982. Contract AS05-76ER02408. 30p. NTIS, PC A03/MF A01. Order Number DE83004562.

The theoretical description of atomic Coulomb excitation and ionization is examined in the context of the general theory of atomic collisions. (WHK)

13237 **(DOE/ER/10985—1) Seventh international seminar on ion-atom collisions (ISIAC VII): summary.** (Connecticut Univ., Storrs (USA). Dept. of Physics). 1981. Contract FG02-81ER10985. 19p. NTIS, PC A02/MF A01. Order Number DE83004079.

Portions of document are illegible.

The scientific program was structured into eight symposia representing seven important research areas. The subject matter was expanded to include ion-molecule collisions as one of the eight symposia. The symposia were: (1) collisions involving strong binding phenomena and nuclear effects; (2) low-energy, high charge state collisions; (3) Rydberg states; (4) an Open Session; (5) ion-molecule collisions; (6) laser applications to atomic and molecular collisions; (7) collision spectroscopy; and (8) polarization, alignment and correlation.

13238 **(INIS-SU—115) Proceedings of 10. All-Union conference on physics of charged particles interaction with crystals. Part 2.** (AN SSSR, Moscow; Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya SSSR, Moscow; Moskovskij Gosudarstvennyj Univ. (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki). 1981. 322p. (In Russian). (CONF-7905159—Pt.2). NTIS (US Sales Only), PC A14/MF A01. Order Number DE83780082.

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

13239 (INIS-SU—125, pp 263) **Auger KMM transitions of thulium arising in $_{70}{}^{169}$Yb decay.** Babenkov, M.I.; Bobykin, B.V.; Zhdanov, V.S. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13240 (INIS-SU—125, pp 288) **Relativistic electron bremsstrahlung in the resonance electromagnetic field.** Batkin, I.S.; Almaliev, A.N. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13241 (INIS-SU—125, pp 160) **Radiationless excitation of the nucleus in the ^{238}U muonic atoms.** Karpeshin, F.F.; Nesterenko, V.O. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13242 **(ZfI-Mitt—43a) Proceedings of the 2. Working Meeting on Radiation Interaction. Selected papers - part 1.** Brede, O.; Mehnert, R. (eds.). (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). Sep 1981. 258p. (CONF-8009281—Pt.1). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83780129.

From 2. working meeting on radiation interaction; Leipzig, F.R. Germany (22 Sep 1980).

Abstracts of individual items from the meeting were prepared separately for the data base.

13243 **Angular distributions of channeled pions and protons up to 250 GeV/c.** Sun, C.R.; Gibson, W.M.; Kim, I.J.; Williams, G.O. (State Univ. of New York, Albany (USA)); Hasan, M.A.; Kanofsky, A.S.; Allen, R. (Lehigh Univ., Bethlehem, PA (USA)); Carrigan, R.A. Jr.; Chrisman, B.L.; Toohig, T.E. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Physics [Section] B;* 203: No. 1, 40-57(9 Aug 1982).

Channeling phenomena are observed for positive particles of momentum up to 250 GeV/c in a germanium crystal. The polar angular distributions of the channeled particles are compared with theoretical predictions based on a diffusion model. The results indicate that at high particle energy there may be additional mechanisms besides those operative at low energy leading to dechanneling of the particles. In spite of this, channeling effects are observed for particles incident at up to several times the critical angle, in contrast with the results from low energy channeling. Statistical equilibrium in the azimuthal angular distribution has also been observed at all measured beam momenta to about twice the calculated channeling critical angle. The breakdown of statistical equilibrium for the 2 cm crystal used occurs at an incident angle 2-3 times smaller than predicted theoretically.

13244 **Multicoincidence techniques in atomic physics.** Fayeton, J.A.; Brenot, J.C.; Houver, J.C. (Paris-11 Univ., 91 - Orsay (France)). pp 525-531 of Physics of electronic and atomic collisions. Invited papers of the 12th international conference held at Gatlinburg, TN, USA, 15-21 July, 1981. Datz, S. (ed.) (Oak Ridge National Lab., TN (USA)). Amsterdam, Netherlands; North-Holland (1982).

From 12. IPEAC international conference on the physics of electronics and atomic collisions; Gatlinburg, TN, USA (15 Jul 1981).

The "multicoincidence technique" results from the combination of two experimental methods which are widely developed in atomic physics, namely the "position sensitive detection" and the coincidence technique. This new technique which actually consists in taking coincidence data in several channels, simultaneously, combines the advantage of both methods reduction of data acquisition time and more accurate identification of the various processes occurring in a collision. The purpose of this paper is to describe the electronic devices developed by various authors and to compare their relative performances and limitations. Applications to atomic collisions are exemplified.

13245 **Laser techniques for extreme ultraviolet spectroscopy.** McIlrath, T.J.; Freeman, R.R. (eds.). New York, NY; American Institute of Physics (1982). 509p.

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

13246 **Molecular Rydberg transitions. X. correlation algorithms for Rydberg term values.** Hochmann, P. (Louisiana State Univ., Baton Rouge); Findley, G.L.; McGlynn, S.P. *Zeitschrift fuer Naturforschung;* **35a**: 1-15(Jul 1980).

The empirical linear correlations of Rydberg term values are discussed in a first-order perturbation-theoretic format. In the second-order, quadratic dependencies are expected. The theoretical development assumes that the gross features of interatomic and intermolecular Rydberg term value variations can be discerned using a one-electron model; that a molecule XS, X being the Rydberg chromophore and S the substituent, can be partitioned so that the affairs of the optical electron are dominated by its interactions with the chromophoric segment; and that the charge distributions, whether of X or S, can be expanded in ways which permit evaluation of the effects of small variations in either X or S on Rydberg term values. The development is restricted to Class 1 molecules: Molecules which possess a common S and variable X. A variety of correlative algorithms is discussed, and the intergroup transferability of parameters is elaborated in terms of the properties of "average chromophores."

6404 Fluid Physics

REFER ALSO TO CITATION(S) 12320, 13409

13247 **(BROWN/HET—480) Green's functions at zero viscosity.** Fried, H.M.; Tessendorf, J. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1982. Contract AC02-76ER03130. 20p. NTIS, MF A01; 2. Order Number DE83004528.

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Fradkin-type propagator representations are written for solutions to Navier-Stokes and related equations, for arbitrary dimension D and arbitrary source geometry. In the limit of very small viscosity, velocity/vorticity solutions are given in terms of Cauchy position coordinates q of a particle advected by the velocity flow v, using a set of coupled equations for q and v. For localized point vortices in two dimensions, the vectors q become the time-dependent position coordinates of interacting vortices, and our equations reduce to those of the familiar, coupled vortex problem. The formalism is, however, able to discuss three-dimensional vortex motion, discrete or continuous, including the effects of vortex stretching. The mathematical structure of vortex stretching in a D-dimensional fluid without boundaries is conveniently described in terms of an SU(D) representation of these equations. Several simple examples are given in two dimensions, to anchor the method in the context of previously known, exact solutions. In three dimensions, vortex stretching effects are approximated using a previous strong coupling technique of particle physics, enabling one to build a crude model of the intermittent growth of enstrophy, which may signal the onset of turbulence. For isotropic turbulence, the possibility of a singularity in the inviscid enstrophy at a finite time is related to the behavior of a single function characterizing the intermittency.

13248 **(EUR—7427(pt.1)) CONVEC: a computer program for transient incompressible fluid flow based on quadratic finite elements. Part 1: theoretical aspects.** Laval, H. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 55p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703393.

This report describes the theoretical and numerical aspects of the finite element computer code CONVEC designed for the transient analysis of two-dimensional plane or three-dimensional axisymmetric incompressible flows including the effects of heat transfer. The governing equations for the above class of problems are the time-dependent incompressible Navier-Stokes equations and the thermal energy equation. The general class of flow problems analysed by CONVEC is discussed and the equations for the initial-boundary value problem are represented. A brief description of the finite element method and the weighted residual formulation is presented. The numerical solution of the incompressible equations is achieved by using a fractional step method. The mass lumping process associated with an explicit time integration scheme is described. The time integration is analysed and the stability conditions are derived. Numerical applications are presented. Standard problems of natural and forced convection are solved and the solutions obtained are compared with other numerical solutions published in the literature.

13249 **Superheating limits of liquid helium I.** Sinha, D.N. (Los Alamos National Lab., NM (USA)); Semura, J.S. (Portland State Univ., Oregon (USA). Dept. of Physics); Brodie, L.C. (Portland State Univ., Oregon (USA). Environmental Sciences and Resources Program). *Cryogenics;* **22**: No. 8, 391-394(Aug 1982).

It is shown that the maximum superheat temperature ΔTsub(max) in liquid helium I, determined under steady-state peak nucleate boiling conditions, cannot be realistically estimated from the thermodynamic limit of superheat (spinodal), as has been previously claimed. It is suggested that a more meaningful estimate of ΔTsub(max) can be obtained from the kinetic limit of super-heat (homogenous nucleation temperature). Experimental data on the homogeneous nucleation superheat temperature, ΔTsub(h), in liquid helium I over an extended temperature range are presented and compared with the ΔTsub(max) measurements of several investigators. It is pointed out that in any quantitative predictions of ΔTsub(max), a knowledge of ΔTsub(h) alone is not sufficient. In fact, the measured value of ΔTsub(max) can lie either below or even above ΔTsub(h) depending on the bath temperature, conditions of the surface, and the thermophysical properties of both heater and liquid.

6450 High Energy Physics

REFER ALSO TO CITATION(S) 12471, 12929, 13292

13250 **(DOE/ER/05490—37) Research in elementary-particle physics. Progress report, May 1, 1982-April 30, 1983.** Chan, L.H.; Haymaker, R.; Imlay, R.; Metcalf, W. (Louisiana State Univ., Baton Rouge (USA)). 1983. Contract AS05-77ER05490. 31p. NTIS, PC A03/MF A01; 1. Order Number DE83005132.

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We describe the possible use of quark mass interpolation to extract physical information from hadron mass splittings phenomenologically and a new approach to the QCD spectral sum rules. We further describe work on dynamical symmetry breaking in gauge theories.

13251 **(INIS-SU—119) Physics of atoms and elementary particles. Semantic collection of scientific papers.** Abuev, F.V. (ed.). (Ministerstvo Vysshego i Srednego Spetsial'nogo Obrazovaniya Azerbajdzhanskoj SSR, Baku). 1981. 139p. (In Russian). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83780227.

The papers included were entered in the data base separately. (WHK)

13252 **Novel results in particle physics.** Panvini, R.S.; Alam, M.S.; Csorna, S.E. (eds.). New York, NY; American Institute of Physics (1982). 398p. (CONF-8205116—).

From 5. international conference on novel results in particle physics; Nashville, TN, USA (24 May 1982).

Results presented at the conference included such diverse topics as quark searches, evidence for a monopole, proton decay experiments, and the latest data from the new CERN proton-antiproton collider. Significant results from more conventional experiments were also presented. The theory talks stressed the physics of 100 GeV and beyond. Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 12932, 12940

13253 **(BNL—32247) Measurement of nu/sub e/ and anti nu/sub e/ elastic scattering as a test of the standard model.** Abe, K.; Taylor, F.E.; White, D.H. (Brookhaven National Lab., Upton, NY (USA); Northern Illinois Univ., Dekalb (USA)). 1982. Contract AC02-76CH00016. 41p. (CONF-8206116—14). NTIS, PC A03/MF A01. Order Number DE83004594.

From DPF summer study on elementary particle physics and future facilities; Aspen, CO, USA (28 Jun 1982).

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Various tests of standard SU(2) x U(1) model of weak interactions which can be performed by measurements of electron and muon neutrino-electron elastic scattering are reviewed. Electron neutrino-electron elastic scattering has both a neutral current part as well as a charged current part, and therefore offers a unique place to measure the interference of these two amplitudes. A measurement of the y-dependence of neutrino-electron elastic scattering can separately measure g/sub V/ and g/sub A/ as well as test for the presence of S, P, or T terms. Several measurable quantities involving cross sections and the interference term are derived from the standard model. Various design considerations for an experiment to determine the NC-CC interference term and the y-dependence of muon neutrino-electron elastic scattering are discussed.

13254 **(BNL—32264) Search for production of narrow p anti p states with a 5 GeV/c p beam.** Bensinger, J.; Kirsch, L.; Morris, W. (Brandeis Univ., Waltham, MA (USA); Brookhaven National Lab., Upton, NY (USA); Cincinnati Univ., OH (USA); Florida State Univ., Tallahassee (USA); Southeastern Massachusetts Univ., North Dartmouth (USA)). 1982. Contract AC02-76CH00016. 8p. (CONF-8208103—1). NTIS (US Sales Only). Order Number DE83003939.

From 4. European symposium on anti NN and anti QQ interactions; Santiago de Compostella, Spain (30 Aug 1982).

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A high-statistics search for the production of narrow p anti p states with a anti p beam at 5 GeV/c finds no evidence for such states from threshold up to 2.3 GeV. In particular, we set an upper limit (95% C.L.) of 9 nb for any state below 1.95 GeV with $\Gamma \leqq 5$ MeV in the reaction p anti $\rightarrow$ p anti p π^0.

13255 **(DESY—82-022) Analysis of the energy weighted angular correlations in hadronic e^+e^- annihilations at 22 and 34 GeV.** Behrend, H.J.; Chen, C.; Fenner, H.; Field, J.H.; Schroeder, V.; Sindt, H.; D'Agostini, G.; Apel, W.D.; Banerjee, S.; Bodenkamp, J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750927.

Measurements of energy weighted angular correlations in electron positron annihilations at c.m. energies of 22 GeV and 34 GeV are presented. The data are compared with perturbative QCD predictions. The theoretical predictions which refer to the partons describe the data reasonably well, depending on the approximations chosen. The effective strong coupling constant αsub(s) has been evaluated using a method where the effect of fragmentation is minimal. At large acolinearity angles QCD calculations going beyond the Leading Double Log approximation appear to be quite successful. The agreement is improved when the smearing effect of heavy resonance decays is taken out of the data.

13256 **(DESY—82-023) Search for charged scalar particles pair produced in e^+e^- annihilation.** Bartel, W.; Cords, D.; Dittmann, P.; Eichler, R.; Felst, R.; Haidt, D.; Krehbiel, H.; Meier, K.; Naroska, B.; O'Neill, L.H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750926.

We have searched for unstable charged scalar particles (S^{+-}) such as techni-pions or charged Higgs particles pair produced in high energy e^+e^- annihilation. No evidence for such particles was observed in both decay modes $e^+e^- \rightarrow S^+S^- \rightarrow$ (tauν)(hadrons) and $\rightarrow$ (tauν)(tauν). Upper limits of 4 to 11% are obtained for the branching ratio $S^{+-} \rightarrow$ (tauν) in the S^{+-} mass range between 4 to 12 GeV.

13257 **(DOE/ER/03956—T1) Double Regge exchange in rho $\Delta\pi$ and rho rho N final states from π^-p interactions at 8 GeV/c.** Kitagaki, T.; Tanaka, S.; Yuta, H. (Tohoku Univ., Sendai (Japan); Massachusetts Inst. of Tech., Cambridge (USA); Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). [nd]. Contract AS05-76ER03956. 41p. NTIS, PC A03/MF A01. Order Number DE83004705.

We present a comparison of the double Regge model with the results from rho $\Delta\pi$, rho rho N and $nA_3^-\pi^+$ production from π^-p interactions. Our study differs from previous studies in that a Deck type mechanism is forbidden by internal quantum number conservation at the vertices, and, thus, represents a more general test of the double-Regge model in the 5 to 20 GeV energy range. The large statistics of our exposure enabled an adequate sample of the desired final states to conduct such a comparison. The gross features of the data, when restricted to definite peripheral regions of phase space, were accounted for by a combination of simple Regge exchanges. The details of the model do require a more elaborate analysis.

13258 **(FERMILAB-Conf—82/69-EXP) Dimuon production in hadronic interactions.** Cox, B. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1982. Contract AC02-76CH03000. 8p. (CONF-820718—18). NTIS, PC A02/MF A01. Order Number DE83002100.

From 21. international conference on high energy physics; Paris, France (29 Jul 1982).

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This report summarizes the new data submitted to the XXI International Conference on High Energy Physics on high mass dimuon production in π^-N and anti pN interactions by Fermilab Experiment E-537, CERN Experiment NA3 and Fermilab Experiment E-326. Successes and failures of the Drell-Yan model and low order QCD are reviewed. New results on the production of the J/psi from E-537, NA3 and CERN experiment WAll are also reported.

13259 **(FERMILAB-CONF—82/87) Transverse momentum spectra of dimuons produced in hadronic interactions and comparison with QCD.** Malhotra, P.K. (Fermi National Accelerator Lab., Batavia, IL (USA)). Dec 1982. Contract AC02-76CH03000. 24p. (CONF-8210107—1). NTIS, PC A02/MF A01. Order Number DE83004464.

From Workshop on Drell-Yan processes; Batavia, IL, USA (7 Oct 1982).

Portions of document are illegible.

We have reviewed comprehensively the data on the transverse momentum spectra (p/sub T/) of high mass lepton pairs produced in hadronic interations. The data are extensively compared with the predictions of Quantum Chromo Dynamics to O(α/sub s/), including some O(α/sub s/²) effects through the use of a p/sub T/ independent K factor. Sensitivity of the calculations to variations in the parameters used is discussed. A compilation of the K factor is given. Possible nuclear effects which can contribute to cross section or alter differential distributions in p/sub T/, x/sub F/ or mass for the dimuon production in nuclear targets are discussed. Linear fits to the data on <p/sub T/²> vs s and <p/sub T/> vs √s for π^-N and pN reations are presented. Using the average value of the intrinsic transverse momentum squared deduced from fits to <p/sub T/²> vs s, predictions of the QCD are calculated and compared with the data. An important conclusion arrived at is that QCD to O(α/sub s/) is not able to account for the observed features of the p/sub T/ distributions in a satisfactory manner.

13260 **(FERMILAB-Conf—82/97-EXP) Charged-hyperon production by 400-GeV/c protons.** Teig, L.J.; Anderson, E.W.; Ankenbrandt, C. (Fermi National Accelerator Lab., Batavia, IL (USA); Iowa Univ., Iowa City (USA); Iowa State Univ. of Science and Technology, Ames (USA); Yale Univ., New Haven, CT (USA)). Dec 1982. Contract AC02-76CH03000. 8p. (CONF-820941—8). NTIS, PC A02/MF A01. Order Number DE83004392.

From 5. international symposium on high energy spin physics; Upton, NY, USA (16 Sep 1982).

We report preliminary results from Fermilab Experiment E-497 on the x and P/sub t/ dependence of charged hyperon and anti-hyperon production by 400 GeV/c protons on a Cu target.

13261 **(FRNC-TH—1063) Study of the antiνsub(μ)p interactions with a liquid hydrogen sensitive target surrounded with a Ne-H_2 mixture.** Gril, Philip. (Paris-11 Univ., 91 - Orsay (France)). Sep 1981. 151p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83780188.

Thesis.

A study is made of the interactions of muonic neutrinos and antineutrinos with the proton of a BEBC bubble chamber fitted with a liquid hydrogen target surrounded with a H_2-neon mixture and completed by an external detector of muons. The following interactions are concerned: νsub(μ) p → μ^- (p or n) + k_1 π^{+-} + k_2 π^0 and antiνsub(μ) p → μ^+ (p or n) + k'_1 π^{+-} + k'_2 π^0. One must be able to reconstruct correctly the π^0 and to select those events comprising a proton or a neutron in the final state. Two methods were employed for determining the energy of the gamma resulting from the decay of the π^0. An original method was developed to isolate the reactions with protons from those with neutrons. The initial comparative results of the fragmentation into π^{+-} and π^0 are given.

13262 (INIS-SU—125, pp 291) **Effect of the crystal structure of the medium on the evolution of the electromagnetic shower.** Nadzhafov, I.M.; Mirantsev, L.V. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13263 **(IS-T—983) Phi production and the OZI rule in πid interactions at 10 GeV/c.** Hendrickson, J.S. (Ames Lab., IA (USA)). Jan 1982. Contract W-7405-ENG-82. 140p. NTIS, PC A07/MF A01. Order Number DE83004983.

Thesis.

A study of the Okubo Zweig-Iizuka (OZI) rule in π^+d interactions at 10 GeV/c has been performed using the Large Aperture Solenoid Spectrometer (LASS) at the Stanford Linear Accelerator Center. Measurements of the cross sections σ(π^+n → phi p) = 179 +- 72 nb and σ(π^+p → phi Δ^{++}) = 172 +- 75 nb for the OZI forbidden reactions π^+n → phi p and π^+p → phi Δ^{++} are consistent with the hypothesis of the phi being produced solely by its non-strange quark component as determined from the octet-singlet mixing angle resulting from application of the Gell-Mann-Okubo mass formula to the vector meson nonet. A cross section upper limit for the interesting OZI rule associated reaction π^+n → K^+ phi Λ is measured to be σ(π^+n → K^+ phi Λ) < 66 nb. A cross section is established for the $K^+K^-\pi^+\pi^-$ decay mode of the phi prime; σ(π^+n → phi'p)B(phi' → $K^+K^-\pi^+\pi^-$) = 528 +- 290 nb. An upper limit for the K/sub s/^{0}/K/sup +-/π/sup -+/ decay mode of the phi prime is established as a function of the phi prime mass.

13264 **(LA—9566-MS) Consideration of a measurement of absolute value eta ∞ ²/absolute value eta/sub +-/² at LAMPF II.** Cronin, J.W. (Los Alamos National Lab., NM (USA)). Nov 1982. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01. Order Number DE83004995.

The possibility of measuring absolute value eta∞²/absolute value eta/sub +-/² with an accuracy of better than 0.5% at LAMPF II is explored. A possible design of an experiment is presented.

13265 **(LBL—15071) HISS spectrometer at the Bevalac.** Greiner, D.E. (Lawrence Berkeley Lab., CA (USA)). Oct 1982. Contract AC03-76SF00098. 17p. (CONF-820979—4). NTIS (US Sales Only). Order Number DE83004116.

From International conference on nucleus-nucleus collisions; East Lansing, MI, USA (27 Sep 1982).

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The status of the HISS spectometer is presented. Preliminary data from multi-particle measurements of the ^{12}C reactions at 1 GeV/n are discussed.

13266 **(SLAC-PUB—2992) Measurement of the tau lifetime.** Jaros, J.A. (Stanford Linear Accelerator Center, CA (USA)). Oct 1982. Contract AC03-76SF00515. 4p. (CONF-820718—23). NTIS, PC A02/MF A01. Order Number DE83004411.

From 21. international conference on high energy physics; Paris, France (29 Jul 1982).

If the tau lepton couples to the charged weak current with universal strength, its lifetime can be expressed in terms of the muon's lifetime, the ratio of the masses of the muon and the tau, and the tau's branching ratio into e anti nu/sub e/ nu/sub tau/ as tau/sub tau/ = tau/sub μ/ (m/sub μ//m/sub tau/)^5 B(tau → e anti nu/sub e/nu/sub tau/) = 2.8 +- 0.2 x 10^{-13} s. This paper describes the measurement of the tau lifetime made by the Mark II collaboration, using a new high precision drift chamber in contunction with the Mark II detector at PEP. The results of other tau lifetime measurements are summarized.

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 13253, 13257, 13259, 13298, 13359

13267 **(BNL—32188) Evidence for glueballs.** Lindenbaum, S.J. (Brookhaven National Lab., Upton, NY (USA); City Coll., New York (USA)). 1982. Contract AC02-76CH00016. 15p. (CONF-8210113—1). NTIS (US Sales Only). Order Number DE83005147.

From American Physical Society meeting on pariticles and fields; College Park, MD, USA (28 Oct 1982).

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This paper describes the observation and partial wave analysis of 1203 (22 GeV) π^-p → phi phi n events. This is an OZI suppressed channel in which the OZI suppression is found to be absent. Assuming QCD and the OZI rule as Ansatzen, it is concluded that the breakdown of the OZI suppression is due to glueballs. The g/sub T/(2160) and the g/sub T/(2320) with I/sup G/J/sup PC/ = 0^+2^{++} are two resonances determined from the partial wave analysis. It is concluded that one or two primary glueballs with the above quantum numbers are responsible for the observed

two states. A brief discussion of other glueball candidates and some relevant phenomenology is also included.

13268 **(BNL—32263) Search for new heavy technipartícles.** Baltay, C.; Gordon, H. (Columbia Univ., New York (USA); Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 6p. (CONF-8206116—16). D. Order Number DE83003945.

From DPF summer study on elementary particle physics and future facilities; Aspen, CO, USA (28 Jun 1982).

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In this article, we consider in some detail an experiment to search for the Technieta (eta/sub T/), which is expected to be in the 100 to 300 GeV mass range. For the sake of concreteness we use the predictions of the technicolor models; however, it might be better to think of these considerations as an example of the kind of searches that should be carried out with the next generation of hadron-hadron colliders, without putting too much importance on the details of the theoretical models that happen to be in fashion at this time. The general notion of an ~ TeV mass scale and the rough value of the coupling strengths of the new mass scale to the present quarks, leptons, and gluons seem more reliable than details of the particular models.

13269 **(DESY—82-024) SU(3) lattice Monte Carlo calculation of the glueball mass spectrum.** Schierholz, G.; Ishikawa, K.; Teper, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750925.

We have calculated the glueball masses of various spins and parities in SU(3) gauge theory.

13270 **(DESY—82-025) Application of Gegenbauer integration method to e^+e^- annihilation process.** Lampe, B.; Kramer, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). May 1982. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82750924.

We apply the Gegenbauer expansion method to the evaluation of integrals encountered in virtual higher order QCD corrections to e^+e^- annihilation 3-jet cross sections. With these integrals the cross sections sigma = sigmasub(U) + sigmasub(L) and sigmasub(L) are calculated.

13271 **(DOE/ER/01545—325) Neutrino mixing in grand unified models.** Tanaka, K. (Ohio State Univ., Columbus (USA). Dept. of Physics; Helsinki Univ. (Finland). Dept. of Theoretical Physics). 1982. Contract AC02-76ER01545. 20p. (CONF-820991—1). NTIS, PC A02/MF A01. Order Number DE83004342.

From 8. international workshop on weak interactions and neutrinos; Javea, Spain (5 Sep 1982).

We discuss generation of fermion masses and the resulting quark mixing and neutrino mixing angles in grand unified models with scalars and without scalars.

13272 **(DOE/ER/03227—76) Theory of high-energy collision processes. Technical progress report, January 1-December 31, 1982.** (Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences). 16 Dec 1982. Contract AC02-76ER03227. 6p. (COO—3227-76). NTIS, PC A02/MF A01. Order Number DE83004683.

The research areas are briefly reviewed, and publications are listed. (WHK)

13273 **(DOE/ER/10528—3) Report on results about weak and electroweak decays of hadrons and related phenomenological Lagrangians. Progress report.** (Kansas Univ., Lawrence (USA). Dept. of Physics and Astronomy). 1983. Contract AC02-79ER10528. 17p. NTIS, PC A02/MF A01. Order Number DE83005187.

Research on weak and electro-weak decays of hadrons and related phenomenological Lagrangians is summarized. Publications are listed. (WHK)

13274 **(DOE/ER/10587—2) Theoretical studies of high-energy phenomena: analysis of models of CP and T violation. Progress report, May 1, 1981-April 30, 1983.** Sachs, R.G. (Chicago Univ., IL (USA). Enrico Fermi Inst.). Dec 1982. Contract AC02-80ER10587. 7p. NTIS, PC A02/MF A01. Order Number DE83004333.

A study of the consequences of maximal CP-violation in the six quark model of Kobayashi and Maskawa (K-M) has been carried out. A redetermination of the K-M parameters from the K^0, K^{-0} data has led to several new results: (1) low energy dispersive contributions to Δm = m/sub L/ - m/sub S/ are probably at least as large as the contribution of the box diagram; (2) the contribution of the double penguin diagram may also be significant; (3) fitting the measured Δm by the sum of these three provides a reasonable estimate of the infrared cutoff for asymptotic freedom of $\mu \approx 1$ GeV; (4) this fit also places an upper limit on the top quark mass, m/sub t/ $\leqq$ 45 GeV. An estimate has been made of the dilepton charge asymmetry to be expected from B^0, B^{-0} decay where the B's are produced in e^+e^- collisions. Measurable charge asymmetries of only one or two percent result from this model. Another, similar experiment is suggested: comparison of the ratio of like-charge to unlike-charge dileptons produced by neutrinos with that produced by antineutrinos. The results are essentially the same. Finally, it is shown that corresponding T^0 - T^{-0} interference effects can be expected to be undetectable in general for the K-M model because the model leads to a very small value of ($\Delta m/\Gamma$)/sub T. An analysis of the data on baryon magnetic moments has been completed. It is found that the non-relativistic constituent quark model can account for the data if mixing of angular momentum states and mixing of SU(3) states to the order of 10 percent each are taken into account. This is consistent with effects to be expected from first order relativistic corrections to the wave function.

13275 **(DOE/ER/40048—17-P2) Oscillating neutrons and disappearing baryons: a theoretical overview.** Seckel, D.; Zee, A. (Washington Univ., Seattle (USA)). May 1982. Contract AC06-81ER40048. 18p. (CONF-820470—3). NTIS, PC A02/MF A01; 1. Order Number DE83004929.

From Nuetron-antineutron oscillation workshop; Cambridge, MA, USA (30 Apr 1982).

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Baryon and lepton number are accidental symmetries in the standard SU(3) x SU(2) x (U)1 theory. We discuss the implications of this for neutron oscillations and compare the situation with that in proton decay. To illustrate our arguments we briefly discuss several models where neutron oscillations might be observed with tau/sub n anti n/ ~ 10^8 - 10^9 sec. In particular, just to prove a point, we construct a grand unified model with neutron oscillation but no proton decay.

13276 **(FERMILAB-Conf—82/86) Jets: models versus experimental data, I.** Orava, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1982. Contract AC02-76CH03000. 35p. (CONF-820983—2). NTIS (US Sales Only). Order Number DE83004509.

From Europhysics study conference on jet structure from quark and lepton interactions; Erice-Trapani-Sicily, Italy (12 Sep 1982).

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Present status of jet studies is reviewed with the special emphasis on the merits of various tests of jet models.

13277 **(INFN/AE—82/4) Confinement and hadron-hadron interactions by general relativistic methods.** Recami, E. (Istituto Nazionale di Fisica Nucleare, Catania (Italy)). 17 Jun 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900837.

By postulating covariance of physical laws under global dilations, one can describe gravitational and strong interactions in a unified way. Namely, in erms of the new discrete dilational degree of freedom, our cosmoc and hadrons can be regarded as finite, similar systems. And a discrete hierarchy of finite universes may be defined, which are governed by fields with strengths inversally proportional to their radii; in each universe an Equivalence Principle holds, so that the relevant field can be there geometrized. Scaled-down Einstein equations - with cosmological term - are assumed to

hold inside hadrons (= strong micro-cosmoses); and they yield in a natural way classical confinement, as well as asymptotic freedom, of the hadron constituents. In other words, the association of strong micro-universes of Friedmann type with hadrons (i.e., applying the methods of General Relativity to subnuclear particle physics) allows avoiding recourse to phenomenological models so as the Bag Model. Inside hadrons we have to deal with a tensorial field (= strong gravity), and hadron constituents are supposed to exchange spin-2 gluons. Our approach allows us also to write down a tensorial, bi-scale field theory of hadron-hadron interactions, based on modified Einstein-type equations here proposed for strong interactions in our space. We obtain in particular: (1) the correct Yukawa behavior of the strong scalar potential at the static limit and for $r \geqq 1$ fm; (2) the value of hadron radii. As a byproduct, we derive a whole numerology, connecting our gravitational cosmoc with the strong micro-cosmoses (hadrons), such that it does imply no variation of G with the epoch. Finally, since a structure of the micro-universe type seems to be characteristic even of leptons, a hope for the future is including also weak interactions in our classical unification of the fundamental forces.

13278 **(IS-T—1017) Forward dimuons from πN interactions at Fermilab: design and construction of a scintillation-counter hodoscope.** McKay, R.L. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 53p. NTIS, PC A04/MF A01. Order Number DE83004979.

Thesis.

There is good evidence that the muon pair production in hadron-hadron interactions occur through quark-antiquark annihilation. If this is the mechanism, it offers a method of measuring the quark structure function of the pion. This experiment is designed to test for the scale invariance and measure the angular distribution of the muon pairs for comparison with current theoretical models. (GHT)

13279 **(RIFP—466) Three-particle relativistic harmonic dynamics in the constraint formalism.** Maheshwari, A. (Kyoto Univ. (Japan). Research Inst. for Fundamental Physics). Jan 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900858.

Three-particle relativistic harmonic dynamics in the constraint formalism has been studied in two different schemes for the reduction of the 24-dimensional covariant phase space to an 18-dimensional minimum phase space. Three body potential for the harmonic problem has been determined from the Bidikov-Todorov equation. It is found that the classical equations of motion are separable in a single time formalism in the case when the phase space is reduced by a set of first class kinematic constraints and the Hamiltonian is introduced as an independent dynamic constraint. For this case in the centre of mass frame the Hamiltonian constraint leads to a time-independent Schroedinger equation which is separable as two independent harmonic oscillators as a special case.

13280 **(SLAC-PUB—2976) Gluonium and QCD in the J/psi region.** Bloom, E.D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.); Stanford Linear Accelerator Center, CA (USA)). Sep 1982. 23p. (CONF-8206136—4). NTIS, PC A02/MF A01. Order Number DE83004481.

From Conference on physics in collision; Stockholm, Sweden (2 Jun 1982).

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The nature of gluonium states is reviewed. QCD is tested in the J/psi region obtaining guidelines for its applicability to the gluonium question. These guidelines along with other current theoretical models are used with new experimental results to examine the nature of the $\iota(1440)$ and $\theta(1640)$ mesons.

13281 **Topological expansion for baryons and mesons.** Stapp, H.P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuovo Cimento [Sezione] A;* **46**: No. 1, 37-60(1 Jul 1978).

A method of including baryons in the topological classification scheme of Veneziano is described. Every amplitude is classified in terms of the number of handles and boundaries of an associated surface. This classification is purely topological. It does not refer to numbers of flavours N, or rely on an equality N^{-1} approximately equal to g^2 that is supposed to be a consequence of the topological expansion. The lowest-order amplitudes are associated with surfaces that have a characteristic tree structure. The analog of Veneziano's planar-discontinuity formula holds.

6453 Particle Invariance Principles And Symmetries

13282 **(INIS-mf—7431) Comments on gauge hierarchies.** Natale, A.A. (Instituto de Fisica Teorica, Sao Paulo (Brazil)). [nd]. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83780180.

The problem of gauge hierarchy in a O(N) model is discussed. It is shown the existence of an upper bound for the hierarchy of order α-$^1/_2$, as proposed by Gildener. This same constraint appears when the breaking is made by the radiative corrections in a scheme elaborated by Weinberg. It is found that fine tunning or redefinition of coupling constants to improve hierarchy, as proposed in several papers, cannot be done before the calculation of higher order contributions to the effective potential. (Author).

6454 Field Theory

13283 **(BNL—32143) Lattice gauge theories.** Rebbi, C. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 19p. (CONF-820718—22). NTIS, PC A02/MF A01. Order Number DE83002827.

From 21. international conference on high energy physics; Paris, France (29 Jul 1982).

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Recent research on lattice gauge theories is reviewed, with particular emphasis being placed on numerical results from Monte Carlo simulations.

13284 **(BNL—32147) Standard model group, QCD subgroup - dynamics isolating and testing the elementary QCD subprocess.** Tannenbaum, M.J. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 11p. (CONF-8206116—18). NTIS, PC A02/MF A01. Order Number DE83003950.

From DPF summer study on elementary particle physics and future facilities; Aspen, CO, USA (28 Jun 1982).

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QCD to an experimentalist is the theory of interactions of quarks and gluons. Experimentalists like QCD because QCD is analogous to QED. Thus, following Drell and others who have for many years studied the validity of QED, one has a ready-made menu for tests of QCD. There are the static and long distance tests. These topics are covered by Peter LePage in the static properties group. In this report, dynamic and short distance tests of QCD will be discussed, primarily via reactions with large transverse momenta. This report is an introduction and overview of the subject, to serve as a framework for other reports from the subgroup. In the last two sections, the author has taken the opportunity to discuss his own ideas and opinions.

13285 **(BNL—32230) Why QCD lattice theory is important to spin physicists.** Rebbi, C. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 6p. (CONF-820941—10). NTIS, PC A02/MF A01. Order Number DE83003955.

From 5. international symposium on high energy spin physics; Upton, NY, USA (16 Sep 1982).

The lattice formulation of a quantum field theory allows calculations in the regime of strong coupling, by expansion techniques, and for intermediate coupling, by Monte Carlo simulations. These computations are especially valuable in the case of Quantum Chromodynamics (QCD), where several of the most important problems are not amenable to a perturbative analysis. Monte carlo simulations, in particular, have recently emerged as a very powerful tool and have been used to evaluate a variety of important physical quantities, such as the string tension, the deconfinement temperature, the scale of the interquark potential, glueball masses and masses in the quark model spectrum. If we consider those problems

of strong interactions where spin plays an important role, it is unlikely, for the moment at least, that the lattice formulation may be of relevance where the phenomena being investigated involve propagations over extended domains of space-time; thus, for instance, it is impossible to perform a meaningful simulation of a scattering experiment on the lattice. But we are at the stage where Monte Carlo calculations begin to provide relevant information on spectroscopic properties related to spin. These are briefly discussed. (WHK)

13286 **(DOE/ER/03285—44) Research in theoretical physics. Annual progress report, April 1, 1982-March 31, 1983.** Domokos, G.; Koevesi-Domokos, S. (Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics). Nov 1982. Contract AC02-76ER03285. 12p. (JHU-HET—8213). NTIS, PC A02/MF A01. Order Number DE83005268.

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The following results are reported: (1) Investigation of a dynamical breakdown of supersymmetry. A non-perturbative investigation of supersymmetric models was carried out in search for a phase transition in such models; none was found. The result was generalized to a no-go theorem: global supersymmetry cannot be broken by stable pair condensates of chiral superfields. (2) Phase transition of hadron matter in high energy nuclear collisions. Direct lepton pairs provide an unambiguous signal; pairs should be looked for in the central region of the rapidity plot. A phase transition is characterized by an enhancement of the pair production rate at invariant masses around 400 MeV.

13287 **(DOE/ER/05490—32) Convexity of the effective potential.** Haymaker, R.W.; Perez-Mercader, J. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 1978. Contract AS05-77ER05490. 7p. NTIS, PC A02/MF A01. Order Number DE83005265.

The effective potential V(phi) in field theories is a convex function of phi. $V(\lambda\ \mathrm{phi}_1 + (1 - \lambda)\mathrm{phi}_2) \leqq \lambda V(\mathrm{phi}_1) + (1 - \lambda)V(\mathrm{phi}_2)$, $0 \leqq \lambda \leqq 1$, all phi_1, phi_2. A linear interpolation of V(phi) is always larger than or equal to V(phi). There are numerous examples in the tree approximation and in perturbation theory for which this is not the case, the most notorious example being the double dip potential. More complete solutions may or may not show this property automatically. However, a non-convex V(phi) simply indicates that an unstable vacuum state was used in implementing the definition of V(phi). A strict definition will instruct one to replace V(phi) with its linear interpolation in such a way as to make it convex. (Alternatively one can just as well take the view that V(phi) is undefined in these domains.) In this note, attention is called to a very simple argument for convexity based on a construction described by H. Callen in his classic book Thermodynamics.

13288 **(DOE/ER/40048—20P2) Summing logs: the saga continues.....** Ellis, S.D. (Washington Univ., Seattle (USA). Dept. of Physics). 1982. Contract AC06-81ER40048. 22p. (CONF-8206117—3). NTIS, PC A02/MF A01. Order Number DE83004923.

From 13. international symposium on multiparticle dynamics; Volendam, Netherlands (6 Jun 1982).

The structure of perturbative Quantum Chromodynamics in kinematic regimes characterized by two large but very different mass scales is discussed. The status of the sequence of approximations employed to theoretically study these regimes is reviewed along with some discussion of the present phenomenology. Various important outstanding questions are noted. 22 references.

13289 **(LBL—15244) Topics in phenomenology of unified gauge theories of weak, electromagnetic, and strong interactions.** Kang, Y.S. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 111p. NTIS, PC A06/MF A01. Order Number DE83004241.

Thesis.

Three phenomenological analyses on the current unification theories of elementary particle interactions are presented. In Chapter I, the neutral current phenomenology of a class of supersymmetric SU(2) x U(1) x U tilde(1) models is analyzed. A model with the simplest fermion and Higgs structure allowing a realistic mass spectrum is considered first. Its neutral current sector is parametrized in terms of two mixing angles and the strength of the new U tilde(1) interactions. Expressions for low-energy model-independent parameters are derived and compared with those of the standard model. Bounds on the neutral gauge boson masses are obtained from the data for various neutrino interactions, eD scattering, and the asymmetry in $e^+e^- \rightarrow \mu^+\mu^-$. In Chapter II, the evolution of fermion mass in grand unified theories is reexamined. In particular, the question of gauge invariance of mass ratios in left-right asymmetric theories is considered. A simple expression is derived for the evolution of the Higgs-fermion-fermion coupling which essentially governs the scale dependence of fermion mass. At the one loop level the expression is gauge invariant and involves only the representation content of left- and right-handed fermions but not that of Higgs. The corresponding expression for supersymmetric theories is also given. In Chapter III, the production and the subsequent decays of a heavy lepton pair L^{+-} near the Z peak in e^+e^- annihilation are considered as a test of the standard model. The longitudinal polarization is derived from the spin-dependent production cross-section, and the decays $L \rightarrow \pi$ nu and $L \rightarrow l$ nu nu are used as helicity analyzers.

13290 **(SLAC-PUB—2970) Testing quantum chromodynamics.** Brodsky, S.J. (Stanford Linear Accelerator Center, CA (USA)). Sep 1982. Contract AC03-76SF00515. 18p. (CONF-8206136—3). NTIS, PC A02/MF A01. Order Number DE83004391.

From Conference on physics in collision; Stockholm, Sweden (2 Jun 1982).

Portions of document are illegible.

The difficulties in isolating specific QCD mechanisms which control hadronic phenomena, and the complications in obtaining quantitative tests of QCD are discussed. A number of novel QCD effects are reviewed, including heavy quark and higher twist phenomena, initial and final state interactions, direct processes, multiparticle collisions, color filtering, and nuclear target effects. The importance of understanding hadron production at the amplitude level is stressed.

13291 **Comment on tumbling gauge theories.** Eichten, E. (Fermi National Accelerator Lab., Batavia, IL (USA); Chicago Univ., IL (USA). Enrico Fermi Inst.); Feinberg, F. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Theoretical Physics). *Physics Letters, [Section] B;* **110**: No. 3/4, 232-236(1 Apr 1982).

We find that for any SU(N) gauge theory, there are no fermion representations which have (1) asymptotic freedom, (2) anomaly cancellation, and (3) a two-fermion channel more attractive than the most attractive two-gluon channel. The attractive force between fermions is compared to that between gluons in the MIT bag model. Therefore mass hierarchies due to tumbling are unlikely to occur in SU(N) gauge theories.

65 PHYSICS RESEARCH

REFER ALSO TO CITATION(S) 13226

13292 **(DOE/ER/01388—883) Experimental and theoretical nuclear physics. Final report.** (Washington Univ., Seattle (USA). Dept. of Physics). 1981. Contract AC06-76ER01388. 20p. NTIS, PC A02/MF A01. Order Number DE83004871.

Major accomplishments in experimental and theoretical nuclear and high energy physics research are briefly reviewed. (WHK)

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 12342, 12471, 12472, 13571

13293 **(ANL—81-79) Physics Division annual review, 1 April 1980-31 March 1981.** (Argonne National Lab., IL (USA)). Jun 1982. Contract W-31-109-ENG-38. 283p. NTIS, PC A13/MF A01. Order Number DE82021147.

Progress in nuclear physics research is reported in the following areas: medium-energy physics (pion reaction mechanisms, high-resolution studies and nuclear structure, and two-nucleon physics with pions and electrons); heavy-ion research at the tandem and superconducting linear accelerator (resonant structure in heavy-ion reactions, fusion cross sections, high angular momentum states in nuclei, and reaction mechanisms and distributions of reaction strengths); charged-particle research; neutron and photonuclear physics; theoretical physics (heavy-ion direct-reaction theory, nuclear shell theory and nuclear structure, nuclear matter and nuclear forces, intermediate-energy physics, microscopic calculations of high-energy collisions of heavy ions, and light ion direct reactions); the superconducting linac; accelerator operations; and GeV electron linac. Progress in atomic and molecular physics research is reported in the following areas: dissociation and other interactions of energetic molecular ions in solid and gaseous targets, beam-foil research and collision dynamics of heavy ions, photoionization- photoelectron research, high-resolution laser rf spectroscopy with atomic and molecular beams, moessbauer effect research, and theoretical atomic physics. Studies on interactions of energetic particles with solids are also described. Publications are listed. (WHK)

13294 **(DOE/ER/02408—208) Progress report, September 1, 1981-August 31, 1982.** (North Carolina Univ., Chapel Hill (USA)). 1982. Contract AS05-76ER02408. 54p. (ORO—2408-208). NTIS, PC A04/MF A01. Order Number DE83004558.

Portions of document are illegible.

Charged particle experiments with polarized beams include studies on isospin mixing in light nuclei, reactions induced by polarized deuterons, and nuclear spectroscopic measurements relevant to the design of solar neutrino detectors (^{80}Kr(vector d,p)^{81}Kr and ^{86}Sr(vector d,p)^{87}Sr). Research on neutron elastic and inelastic scattering at very forward angles is described. Accelerator development, instrumentation development, and computer-related developments are reported. Publications are listed. (WHK)

13295 **(DOE/ER/10638—3) Nuclear-structure studies using the high-resolution spectrometer at the Los Alamos Clinton P. Anderson Meson Physics Facility. Progress report.** (Texas Univ., Austin (USA). Dept. of Physics). Dec 1982. Contract AS05-80ER10638. 126p. NTIS, PC A07/MF A01. Order Number DE83004563.

This document contains a description of the ongoing medium-energy nuclear-physics research program supported by the US Department of Energy with The University of Texas at Austin. A major part of the work is associated with research done using the High Resolution Spectrometer (HRS) at the Los Alamos Clinton P. Anderson Meson Physics Facility (LAMPF); this research focuses on: (1) providing data which test microscopic models of the medium - energy proton + nucleus interaction; (2) providing data which are to be analyzed to provide new nuclear-structure information (both ground state and excited state); and (3) developing and improving the models themselves. Publications are listed.

13296 **(IAEA-NDS—22) PNESD proton nucleus elastic scattering data. Contents and documentation.** DayDay, N. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). Dec 1979. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703061.

The data file PNESD contains numerical data and the related bibliography for the differential elastic cross sections, polarization and integral nonelastic cross sections for protons of 3 MeV to 1000 MeV incident on natural elements and their isotopes. The file can be obtained on magnetic tape free of charge from the IAEA Nuclear Data Section.

6511 Experimental Techniques

REFER ALSO TO CITATION(S) 13343

13297 **(LBL—14980) 4 π physics with the plastic ball.** Gutbrod, H.H.; Loehner, H.; Poskanzer, A.M.; Renner, T.; Riedesel, H.; Ritter, H.G.; Warwick, A.; Weik, F.; Wieman, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Lawrence Berkeley Lab., CA (USA)). Oct 1982. Contract AC03-76SF00098. 22p. (CONF-820979—5; CONF-8210108—1). NTIS, PC A02/MF A01. Order Number DE83004190.

From International conference on nucleus-nucleus collisions; East Lansing, MI, USA (27 Sep 1982).

4 π data taken with the Plastic Ball show that cluster production in relativistic nuclear collisions depends on both the size of the participant volume and the finite size of the cluster. The measurement of the degree of thermalization and the search for collective flow will permit the study of the applicability of macroscopic concepts such as temperature and density.

6512 Nuclear Properties And Reactions, A=1-5

REFER ALSO TO CITATION(S) 13227, 13363

13298 (INIS-SU—125, pp 186) **Contribution of the S' state in Bsub(lambda)(sub(lambda)sup(3)H).** Kopylov, V.A.; Kolesnikov, N.N. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13299 (INIS-SU—125, pp 222) **Algebraic version of resonating-group method and elastic scattering phases of the ^{3}He(n, n)^{3}He, ^{3}H(p, p)^{3}H, ^{2}H(d, d)^{2}H.** Filippov, G.F.; Vasilevskij, V.S.; Kovalenko, T.P. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13300 (INIS-SU—125, pp 340) **Koltun sum rules testing in the (e, e'p) experiments on ^{3}He and ^{4}He.** Gol'dshtejn, V.A.; Startsev, V.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13301 (INIS-SU—125, pp 404) **Two-particle electro-disintegration of ^{3}He in a microscopic approach.** Malyarzh, E.I.; Kozlovskij, I.V.; Tartankovskij, V.K. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

6513 Nuclear Properties And Reactions, A=6-19

REFER ALSO TO CITATION(S) 13265

13302 **(DOE/ER/10714—2) Nuclear physics research. Progress report, April 1, 1982-March 31, 1983.** Mateja, J.F. (Tennessee Technological Univ., Cookeville (USA). Dept. of Physics). 1983. Contract AS05-80ER10714. 58p. NTIS, PC A04/MF A01. Order Number DE83004569.

Portions of document are illegible.

The investigation has been directed into a new experimental area in an attempt to understand the mechanism responsible for the low-energy fusion cross section limitations. After studying the fusion cross sections for four entrance channels which lead to the same compound nucleus (in addition to our previously reported studies of the ^{11}B + ^{12}C and ^{10}B + ^{13}C entrance channels we have added the ^{7}Li + ^{16}O and ^{9}Be + ^{14}N entrance channels to our study of the ^{23}Na compound nucleus) and after studying the systematics of other fusion cross sections in this mass region, it became apparent that those systems showing the smallest fusion cross sections involved projectiles which required small breakup energies. We have initiated a program to study the light particle production for the ^{11}B + ^{12}C and ^{10}B + ^{13}C entrance channels in

an attempt to determine the magnitude of the breakup cross section for these systems. Results are reported. While our study is not complete, it strongly suggests that projectile breakup is indeed the mechanism responsible for the limitations observed in the low energy fusion cross sections. Our overall study seems to suggest that this mechanism begins at energies near the Coulomb barrier and steadily increases in magnitude with increasing bombarding energy. (WHK)

13303 (INFN/BE—82/1) **Surface waves in α-nuclei elastic scattering.** Di Salvo, E.; Viano, G.A. (Istituto Nazionale di Fisica Nucleare, Genoa (Italy)). 16 Jun 1982. 40p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900841.

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We develop in detail a theory of surface waves, excited by the grazing rays in the elastic scattering of α particles on nuclei, working within the framework of the short wavelength approximation. The nuclear interaction region is schematized as an absorbing sphere surrounded by a nearly transparent shell; the surface waves, which are excited at the edge of the interaction region and propagate along it, can take one or more shortcuts. In this way we can explain the large angle elastic scattering of α particles on ^{16}O, ^{28}Si and ^{40}Ca from approx. 20 to approx. 60 MeV. Indeed the theory is tested by fitting the differential cross sections of these scattering processes. The nuclear interaction radii can be extracted from our phenomenological analysis.

13304 (INIS-SU—125, pp 153) **Charge-exchange 1^+ excitations and precritical phenomena in the atomic nuclei.** Tolokonnikov, S.V.; Borzov, I.N. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13305 (INIS-SU—125, pp 193) **Spectroscopic factors of α-decay of giant isoscalar resonances.** Smirnov, Yu.F.; Chuvil'skij, Yu.M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13306 (INIS-SU—125, pp 196) **Algebraic realization of the resonating-group method for multichannel scattering problem in eight nucleons system.** Badalov, S.A.; Filippov, G.F. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13307 (INIS-SU—125, pp 227) **Detailed investigation of ground state structure of ^{6}Li-^{6}He-^{6}Be nuclei.** Krasnopol'skij, V.M.; Voronchev, V.T.; Sazonov, P.B.; Kukulin, V.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13308 (INIS-SU—125, pp 349) **Polarization phenomena in the $e^- + {}^6Li \rightarrow e^- + {}^6Li^*$ process.** Rekolo, M.P. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13309 (INIS-SU—125, pp 350) **Three-particle decay of the 14^+ resonance with 19.7 MeV energy excited in the $^{16}O + {}^{12}C$ reaction.** Gersh, Kh.U.; Shobbert, Kh.; Vibike, Kh.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13310 (INIS-SU—125, pp 399) **Covariant description of magnetic and electric properties of extended nuclei with half-integral spin in electronscattering.** Bogdanov, Yu.P.; Kerimov, B.K.; Safin, M.Ya. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13311 (INIS-SU—125, pp 400) **Electromagnetic and weak scattering of electrons by the 1p shell nuclei and space parity violation.** Bogdanov, Yu.P.; Kerimov, B.K.; Safin, M.Ya. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13312 (IS-T—1012) **Coulomb dissociation in relativistic heavy-ion reactions.** Mercier, M.T. (Ames Lab., IA (USA)). Jul 1982. Contract W-7405-ENG-82. 97p. NTIS, PC A05/MF A01. Order Number DE83005004.

Thesis.

Targets of ^{12}C, ^{59}Co, ^{89}Y, ^{197}Au and ^{238}U were bombarded by 2.1 GeV/A ^1H, ^{12}C and ^{20}Ne profectiles using the SuperHILAC and BEVATRON facilities at Lawrence Berkeley Laboratory (LBL). The beam flux was calculated by monitoring the decya of ^{11}C produced from the ^{12}C(projectile,projectile n)^{11}C reaction. Residual gamma-ray activity from the Co, Y, Au and U targets was collected in order to trace the decay of several reaction products. The experiment focused on the calculation of cross sections for the formation of products with one neutron removed from the various target nuclei. Corrections to the saturation activity of each product were made for detector efficiency, gamma-ray absorption in the target, gamma-ray branching, beam geometry and secondary reactions. Results are presented and discussed.

13313 **C(α,X)^{11}C cross sections at 1.59 and 4.19 GeV.** Geaga, J.V.; Gazzaly, M.M.; Igo, G.J.; McClelland, J.B.; Nasser, M.A.; Sagle, A.L.; Spinka, H. (California Univ., Los Angeles (USA). Dept. of Physics); Carroll, J.B.; McCaslin, J.B.; Perez-Mendez, V. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). *Nuclear Physics [Section] A;* **386**: No. 3, 589-598(4 Oct 1982).

The absolute cross sections for the production of ^{11}C by 1.59 GeV and 4.19 GeV α-particles incident on natural carbon have been measured to be 46.4 +- 1.3 mb and 42.5 +- 1.1 mb respectively. These results, together with data reported at other energies, indicate that the C(α, X)^{11}C cross section becomes approximately constant at a value of about 43 mb for energies above 3 GeV (750 MeV/n). A similar energy dependence is exhibited by the C(p, X)^{11}C reaction whose cross section has been measured previously over an extensive energy range. The C(α, X)^{11}C cross sections are found to be in good agreement with predictions of a semi-empirical model developed to describe nuclear fragmentation.

13314 **Neutron yields from the 4-12 MeV proton bombardment of ^{11}B, ^{13}C and ^{18}0 as related to the production of ^{11}C, ^{13}N and ^{18}f.** Bair, J.K.; Miller, P.D. (Oak Ridge National Lab., TN (USA)); Wieland, B.W. (Oak Ridge Associated Universities, Inc., TN (USA)). *International Journal of Applied Radiation and Isotopes;* **32**: No. 6, 389-395(Jun 1981).

Total neutron yields resulting from the proton bombardment of infinitely thick targets of ^{11}B, sup(NAT)C and ^{28}Sisup(NAT)O_2 have been measured for bombarding proton energies below 12 MeV. From the sup(NAT)C data, the yield from ^{13}C has been derived. From the ^{28}Sisup(NAT)O_2 data the yield for sup(NAT)O has been determined. The measured yields are compared to those calculated from the known thin-target cross sections. The relationship of these neutron yields to the production of the pharmaceutically important short-lived positron emitters, ^{11}C, ^{13}N and ^{18}F is discussed.

6514 Nuclear Properties And Reactions, A=20-38

REFER ALSO TO CITATION(S) 13303, 13310, 13323

13315 **(DOE/ER/40048—25-L2) Isospin mixing in ^{24}Mg.** Hoyle, C.D.; Adelberger, E.G.; Blair, J.S.; Snover, K.A.; Swanson, H.E.; Von Lintig, R.D. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1982. Contract AC06-81ER40048. 53p. NTIS, PC A04/MF A01. Order Number DE83004920.

We have used the β-γ circular polarization (CP) correlation technique to measure the isospin-forbidden Fermi matrix element for the β^+ decay of ^{24}Al to the 4^+ T=1 state in ^{24}Mg at E/sub x/ =8.437 MeV. The ^{24}Al activity was produced by bombarding a natural Mg target with 18 MeV protons. The β-γ CP correlation was measured using a novel apparatus which featured good energy resolution in both the γ and β arms. The CP sensitive γ-ray detector utilized a transmission-mode Compton polarimeter and a 12.7 cm x 15.2 cm NaI detector. The β detector was a telescope with a 700 μm surface barrier detector and a 5.1 cm x 12.7 cm plastic scintillator. The β-γ CP asymmetry A [defined by W(θ, t tilde) = 1 + t tilde v/c A tilde cos θ where t tilde is the photon helicity] was found to be A tilde = -0.145 +- 0.030. After applying a correction for feeding of the 8.437 MeV state from the analog state this value of A tilde corresponds to a charge dependent matrix element between the 9.5 MeV 4^+T=1 and 8.4 MeV T=O levels of [<4^+;O[H/sub CD/]4^+;1>] = 106 +- 40 keV which is the largest matrix element of H/sub CD/ ever observed in β decay. For comparison the charge dependent matrix element between the 9.5 MeV state and the 4.1 MeV 4^+ state, previously measured in ^{24}Na decays is only 5.4 +- 2.2 keV. Our exceptionally large value occurs because the 9.5 MeV T=1 and 8.4 MeV T=O states have very similar space and spin wavefunctions. This matrix element is consistent with predictions which ascribe the entire effect to Coulomb forces.

13316 **(DOE/ER/40048—27-L2) ^{27}Al(p,γ)^{28}Si and ^{27}Al(^{3}He,d)^{28}Si to the stretched 11.58-MeV (6$^-$,0) and 14.36-MeV (6$^-$,1) levels.** Snover, K.A.; Feldman, G.; Hindi, M.M.; Kuhlmann, E.; Harakeh, M.N.; Sasao, M.; Noumachi, M.; Fujita, Y.; Fujiwara, M.; Hosono, K. (Washington Univ., Seattle (USA). Dept. of Physics; Rijksuniversiteit Groningen (Netherlands). Kernfysisch Versneller Inst.; Osaka Univ., Toyonaka (Japan). Dept. of Physics; Osaka Univ., Suita (Japan). Research Center for Nuclear Physics). 1981. Contract AC06-81ER40048. 39p. NTIS, PC A03/MF A01. Order Number DE83004106.

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We have studied the E/sub x/ = 14.36 MeV 6$^-$,T = 1 resonance in the ^{27}Al(p,γ) reaction with the result that Γ/sub Po/ = Γ = 4.0 +- 0.2 keV, from which we infer a (d/sub 5/2/$^-$^{1},f/sub 7/2/) parentage $\delta_1^2 \approx$ 0.7. We also obtain B(M1) = 2.8 +- 0.4 nm^2 or 0.19 +- 0.03 of the pure single particle (d/sub 5/2/$^-$^{1},f/sub 7/2/) value for the 6$^-$,1 $\rightarrow$ 6$^-$,0 M1 γ-decay. ^{27}Al (^{3}He,d) results for stripping to the 6$^-$,1 and the 6$^-$,0 (11.58 MeV) levels indicate S/sub o/(p)/S$_1$(p) = 1.1 +- 0.1 and hence that the 6$^-$,0 level has a (d/sub 5/2/$^-$^{1},f/sub 7/2/) parentage comparable to the 6$^-$,1 level, contrary to inferences based on inelastic proton and pion scattering data. We discuss the hindrance of the M1 decay and the previously measured inelastic electron, proton and pion excitation strengths relative to the expectations of a 1 particle-1 hole model.

13317 (INIS-SU—125, pp 310) **Restriction of the effective number of independent spin channels in a fluctuation analysis.** Artemov, S.V.; Zaparov, Eh.A. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 13303, 13326

13318 (INIS-SU—125, pp 208) **Microscopic description of collective excitations of the ^{44}Ti nuclei in generalized hyperspherical function method.** Okhrimenko, I.P.; Steshenko, A.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

6516 Nuclear Properties And Reactions, A=59-89

REFER ALSO TO CITATION(S) 13312

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 12926, 13233, 13295, 13295, 13370, 13378

13319 **(ANL/NDM—68) Fast-neutron total and scattering cross sections of ^{103}Rh.** Smith, A.B.; Guenther, P.T.; Whalen, J.F. (Argonne National Lab., IL (USA)). Jul 1982. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A01. Order Number DE83004436.

Fast-neutron total cross sections of ^{103}Rh are measured with 30 to 50 keV resolutions from 0.7 to 4.5 MeV. Differential elastic- and inelastic-scattering cross sections are measured from 1.45 to 3.85 MeV. Scattered-neutron groups corresponding to excited levels at 334 +- 13, 536 +- 7, 648 +- 25, 796 +- 20, 864 +- 22, 1120 +- 22, 1279 +- 50, 1481 +- 27, 1683 +- 39, 1840 +- 79, 1991 +- 71 and 2050 (tentative) keV are observed. An optical-statistical model is derived from the elastic-scattering results. The experimental values are compared with comparable quantities given in the ENDF/B-V evaluation.

13320 **(ANL/NDM—73) Fast-neutron elastic-scattering cross sections of elemental tin.** Budtz-Jorgensen, C.; Guenther, P.T.; Smith, A. (Argonne National Lab., IL (USA)). Jul 1982. Contract W-31-109-ENG-38. 21p. NTIS, PC A02/MF A01. Order Number DE83004435.

Broad-resolution neutron-elastic-scattering cross sections of elemental tin are measured from 1.5 to 4.0 MeV. Incident-energy intervals are $\sim$ 50 keV below 3.0 MeV and $\sim$ 200 keV at higher energies. Ten to twenty scattering angles are used, distributed between $\sim$ 20 and 160°. The experimental results are used to deduce the parameters of a spherical optical-statistical model and they are also compared with corresponding values given in ENDF/B-V.

13321 **(BNL-NCS—28878) ENDF/B fission-product data.** Rose, P.F.; Burrows, T.W. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 5p. (CONF-810606—18). NTIS, PC A02/MF A01. Order Number DE83005676.

From American Nuclear Society's annual meeting; Miami Beach, FL, USA (7 Jun 1981).

In recognition of the pressing need for nuclear decay data in a variety of reactor-related applications, the scope of the Evaluated Nuclear Data Files (ENDF/B) was expanded to include such information. The initial reason for this expansion was to provide reliable data and a common data base to be used in computer codes developed to carry out summation calculations of the decay-heat source term in reactor cores. The ENDF/B-V fission product file was released in July 1980 and contains data for 877 nuclides. Forty-two of these are found in greater detail on the General Purpose file. Seven hundred and fifty isotopes contain decay data. One hundred and ninety-six contain cross section data for total, elastic, inelastic, and angular distributions in the energy range 10^{-5} eV to 20 MeV. This special fission product file is contained on 6 magnetic tapes, and is available from the National Nuclear Data Center (NNDC) at BNL. (WHK)

13322 **(DOE/ER/10494—4) Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982.** Walters, W.B. (Maryland Univ., College Park (USA). Dept. of Chemistry). 1982. Contract AS05-79ER10494. 41p. NTIS, PC A03/MF A01. Order Number DE83005474.

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It was found possible to interpret the levels of the odd-odd N = 83 nuclides by parabolic fits to plots of multiplet splitting versus I(I + 1). Parameters are found that account for the splitting, displacement and inversion of these multiplets. It is concluded that the interaction between the odd proton and odd neutron in the N + 83 nuclides is largely a quadrupole interaction. Moreover, the effect of odd I-even I staggering that comes from the δ interaction is not significant. Using the parabolic parameters for ^{140}La, it is

possible to project the low-lying multiplets in ^{143}La and compare them with the new level scheme that has been completed for ^{143}La. The density of observed levels is in accord with the projection and the new 0.87 μs isomer lies at the vertex of one of the paraboli. The first PAC measurements at TRISTAN have been concluded and g factors determined for the first 2^+ states in ^{144}Ba and ^{146}Ba. New level schemes for odd-odd ^{146}La, ^{148}La, and ^{149}Pr reveal sharp differences in the behavior of the 1^+ levels in Pr versus La as neutron pairs are added beyond the closed shell at N + 82. These changes are most important at N + 88. Two new isomers have been identified, a 5 ns level at 48 or 55 keV in ^{141}La and an 870 ns level at 145 keV in ^{143}La. Additional evidence for isomerism in ^{148}Pr has been obtained by careful measurements of the half lives of several intense γ rays and by measuring the intensity of ^{148}Pr γ rays as power is varied on the ion source.

13323 (ECN—81) **Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce.** Balder, J.R. (Stichting Energieonderzoek Centrum Nederland, Petten). Jan 1982. 45p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900847.

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A measurement of the angular correlation of γ-rays emitted in the capture of thermal neutrons in ^{23}Na has been used to determine the multipole mixing ratio δ for seventeen transitions in ^{24}Na, of which seven are primary transitions. For these primary transitions also the capture state spin admixture α has been derived. The neutron capture reaction proceeds predominantly through the J/sup π/ = 1^+ channel, as expected from previous cross-section measurements. A measurement of the circular polarization of γ-rays resulting from the capture of polarized thermal neutrons in ^{138}Ba, ^{140}Ce, and ^{142}Ce has yielded spin assignments for p-states in the final nuclei. Excitation energies and reaction Q-values have been obtained from the analysis of singles spectra taken with unpolarized neutrons.

13324 (INIS-SU—122, pp vp) **Direct process contribution into the hard component of the ^{113}In(n,n′) reaction spectra.** Dovbenko, A.G.; Ignatyuk, A.V.; Lunev, V.P.; Lovchikova, G.N. 1981. (In Russian). NTIS (US Sales Only), PC A06/MF A01.

In Nuclear constants.

The direct process contribution to the hard component of the ^{113}In(n, n′) reaction-spectrum is analysed in terms of the coupled-channels methods for 5.34 and 8.53 MeV neutrons. The observed positive difference between neutron spectra from (n, n′) and (p, n) reactions agrees with results of calculations, which take into account the spectroscopic information on the lowest 2^+ and 3^- collective levels of the neighbouring even-even nuclei.

13325 (INIS-SU—125, pp 87) **Properties of the ^{147}Eu and ^{149}Eu low-lying excited states in the framework of the semimicroscopic quasiparticle-phonon model.** Vdovin, A.I.; Deryuga, V.A.; Kratsikova, T.I.; Figner, M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13326 (INIS-SU—125, pp 156) **Effect the residual force spin components on the properties of the electrical type states in the spherical nuclei.** Nguen Din′ Dang; Ponomarev, V.Yu. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13327 (INIS-SU—125, pp 194) **RPA description of isoscalar resonances in nonmagic nuclei.** Zhalov, M.B.; Kuprikov, V.I.; Bulgak, A. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13328 (INIS-SU—125, pp 233) **Influence of tensor component of effective interaction on the spherical odd-odd nucleus properties.** Artamonov, S.A. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13329 (INIS-SU—125, pp 246-247) **Strength functions of β^+ decay of cesium isotopes.** Bykov, A.A.; Vitman, V.D.; Naumov, Yu.V.; Orlov, S.Yu.; Tarasov, V.K. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13330 (INIS-SU—125, pp 265) **Exchange and overlap corrections to probabilities of electron capture by iodine nuclei in atoms and ions.** Boruta, I.I.; Makaryunas, K.V. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13331 (INIS-SU—125, pp 281) **Systematics of odd nucleus magnetic moments. Spin of the 4.48 MeV ^{92}Mo state.** Avotina, M.P. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13332 (INIS-SU—125, pp 316) **Parameter of nuclear level density spin dependence in the range A approximately 100.** Zarubin, P.P.; Khrisanfov, Yu.V. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13333 (INIS-SU—125, pp 385) **Momentum spectra in reactions of quasi-elastic knock-out of deuteron.** Kadmenskij, S.G.; Ratis, Yu.L. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13334 (LA—9604-MS) **Gamma rays from the interactions of reactor fast neutrons ordered by increasing gamma-ray energy.** Moss, C.E. (Los Alamos National Lab., NM (USA)). Nov 1982. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01. Order Number DE83005601.

Radioactive material handled in nuclear safeguards often emits both gamma rays and neutrons. The gamma rays emitted by the radioactive isotopes are listed in several compilations, which can be used for identification and quantitative analysis of the radioactive isotopes present. Some of the neutrons are moderated and undergo thermal capture. The capture gamma rays are also listed in several compilations that can be used for analysis. However, some of the unmoderated neutrons undergo fast reactions with both radioactive and nonradioactive target isotopes. The dominant type of reaction is usually (n,n′γ). Data on gamma rays from the interaction of fast neutrons are not extensive, and the available ordered lists give only the most common elements. This report presents a table of these gamma rays in order of increasing energy for 77 elements. The present table is based primarily on data acquired at the Baghdad Nuclear Research Institute and analyzed at the I.V. Kurchatov Institute of Atomic Energy. The intensities were measured at 90° to the neutron beam with a Ge(Li) detector and were corrected for self-absorption in the target. In addition to the (n,n′γ) reaction, the (n,pγ) and (n,αγ) reactions were observed on some elements with $Z < 40$. The fast neutron spectrum at E/sub n > 1.5 MeV used for these measurements can be approximated by exp (-0.75 E/sub n/), where E/sub n/ is the neutron energy in MeV. The relative intensities of transitions from levels above 0.5 MeV are not critically dependent on the exponent. The present table includes only the five most intense gamma rays from each element.

13335 (LBL—12811) **Nuclear-deformation energies according to a liquid-drop model with a sharp surface.** Blocki, J.; Swiatecki, W.J. (Lawrence Berkeley Lab., CA (USA)). May 1982. Contract AC03-76SF00098. 861p. NTIS, PC A99/MF A01. Order Number DE83003978.

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We present an atlas of 665 deformation-energy maps and 150 maps of other properties of interest, relevant for nuclear systems idealized as uniformly charged drops endowed with a surface tension. The nuclear shapes are parametrized in terms of two spheres modified by a smoothly fitted quadratic surface of revolution and are specified by three variables: asymmetry, sphere separation, and a neck variable (that goes over into a fragment-deformation variable after scission). The maps and related tables should be useful for the study of macroscopic aspects of nuclear fission and of collisions between any two nuclei in the periodic table.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 13239, 13356

13336 (INIS-SU—125, pp 102) **Calculation of parameters of non-adiabatic rotational model for the sup(153,155,157,159)Eu.** Guseva, T.V.; Repshe, Eh.A.; Tamberg, Yu.Ya. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13337 (INIS-SU—125, pp 142) **Description of giant resonance decay in quasi particle-phonon model.** Malov, L.A. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13338 (INIS-SU—125, pp 144) **Fragmentation of the few quasiparticle components in the deformed nuclei.** Malov, L.A. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13339 (INIS-SU—125, pp 184) **Nonadiabatic deviation of E2-transition probabilities in Yb isotopes.** Muminov, A.I.; Safarov, R.Kh.; Usmanov, F.N. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13340 (INIS-SU—125, pp 235) **Possible interpretation of the negative parity quasi- rotational band structure of ^{156}Er.** Belen'kij, V.M.; Volmyanskij, Eh.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13341 (INIS-SU—125, pp 248) **Calculations of half-life of deformed and spherical nuclei.** Bykov, A.A.; Naumov, Yu.V.; Samojlova, A.N. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13342 (INIS-SU—125, pp 282) **Matrix elements of penetration of the K forbidden ($\Delta K=3$) E1-transitions.** Sergeenkov, Yu.V.; Kharitonov, Yu.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13343 (UCRL—53364) **Development of data-acquisition-and-analysis systems for in-beam gamma-ray spectroscopy: a study of the nucleus ^{180}W.** Carlson, J.B. (Lawrence Livermore National Lab., CA (USA)). 1982. Contract W-7405-ENG-48. 191p. NTIS, PC A09/MF A01. Order Number DE83004992.

Portions of document are illegible. Printed copy available until stock is exhausted. Thesis.

This thesis presents the design and development of state-of-the-art computer based data acquisition and analysis systems for use in nuclear structure research. The applicability and usefulness of these systems for these research tasks has been illustrated by performing and analyzing experiments to study the nucleus ^{180}W. These experimental results and a brief comparison with a statistical model calculation are presented. (WHK)

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 13312, 13326, 13353

13344 (DOE/ER/40048—11-L2) **Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering.** Lynch, W.G.; Tsang, M.B.; Bhang, H.C.; Cramer, J.G.; Puigh, R.J. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). [nd]. Contract AC06-81ER40048. 14p. NTIS, PC A02/MF A01. Order Number DE83004933.

Elastic scattering of p-shell nuclear projectiles from ^{208}Pb has been examined for deviations from Rutherford scattering. Four effects can be important: atomic screening, vacuum polarization, nuclear polarizability and a relativistic effect of dynamical origin. The presence of atomic screening, nuclear polarizability and the relativistic effect was observed thus constituting the first measurement of this relativistic effect using complex nuclei and the first measurement of this relativistic effect using complex nuclei and the first measurement of nuclear polarizability in an external Coulomb field.

13345 (INIS-SU—125, pp 148) **Simplified and semisimplified α-decay of N=125 nuclei and effective nucleon-nucleon interaction.** Vakhtel', V.M.; Kadmenskij, S.G.; Lomachenkov, I.A.; Furman, V.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13346 (INIS-SU—125, pp 210) **Effective interaction and structure of odd spherical nuclei.** Badalov, S.A.; Belen'kij, V.M.; Isakov, V.I.; Sliv, L.A. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13347 (INIS-SU—125, pp 381) **Total and partial proton widths of the Gamow-Teller resonances.** Nikolaev, M.A.; Urin, M.G. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

6520 Nuclear Properties And Reactions, A=220 And Above

REFER ALSO TO CITATION(S) 13241, 13312, 13378

13348 (ANL/NDM—64) **Fission-fragment angular distributions and total kinetic energies for ^{235}U(n,f) from .18 to 8.83 MeV.** Meadows, J.W.; Budtz-Joergensen, C. (Argonne National Lab., IL (USA)). Jan 1982. Contract W-31-109-ENG-38. 33p. NTIS, PC A03/MF A01. Order Number DE83004437.

A gridded ion chamber was used to measure the fission fragment angular distribution and total kinetic energy for the ^{238}U(n,f) reaction from 0.18 to 8.81 MeV neutron energy. The anisotropies are in generally good agreement with earlier measurements. The average total kinetic energy is $\sim$ 0.2 MeV greater than the thermal value at neutron energies $<$ 2 MeV and shows a sudden decrease of $\sim$ 0.8 MeV between 4 and 5 MeV neutron energy, well below the (n, n'f) threshold. Possible causes of this decrease are a change in the mass distribution or decreased shell effects in the heavy fragment.

13349 **(DOE/ER/02184—T1) Nuclear chemistry project. Progress report, April 1, 1982-March 31, 1983.** (Princeton Univ., NJ (USA)). 16 Dec 1982. Contract AC02-76ER02184. 11p. NTIS, PC A02/MF A01. Order Number DE83004522.

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Research on the electric quadrupole and hexadecapole moments of uranium 233 utilizing the hyperfine structure from the muonic x-ray spectra is described. (WHK)

13350 (INIS-SU—109, pp 143-147) **Average values and dispersions of fission fragment kinetic energies in terms of "touching fragments" model.** Rubchenya, V.A. (Radievyj Inst., Leningrad (USSR)). 1980. (In Russian). NTIS (US Sales Only), PC A15/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

The influence of shell structure of fragments on the energy characteristics of fission of nuclei from Ra to Z=116 is studied. The calculated kinetic energies of fragments are in the good agreement with experimental data. The fragment kinetic energy dispersions obtained by statistical averaging are less than experimental data. This might be connected with the non statistical fluctuations of the scission point fragment distance.

13351 (INIS-SU—109, pp 326-330) **Analysis of the average ^{235}U, ^{238}U and ^{239}Pu fission cross sections on ^{235}U and ^{252}Cf fission neutron spectra.** Manturov, G.N.; Gorbachev, L.V.; Tsibulya, A.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.:. 1980. (In Russian). NTIS (US Sales Only), PC A15/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

The evaluations of results of measurement of U-235, U-238 and Pu-239 fission average cross sections on Cf-252 spontaneous fission neutron spectrum and U-235 fission neutron spectrum under the effect of thermal neutrons are obtained. The evaluation results are compared with the results of calculations carried out using energy dependences of fission cross sections taken when constituting ABBN-78 constant system and U-235 and Cf-252 fission neutron spectra in Watt form.

13352 (INIS-SU—125, pp 136) **^{238}U and ^{232}Th levels excited in the (n, n') reactions with 3 MeV neutrons.** Blinov, M.V.; Stsiborskij, B.D.; Filatenkov, A.A.; Shiryaev, B.M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13353 (INIS-SU—125, pp 183) **States of negative parity in even-even nuclei.** Begzhanov, R.B.; Belen'kij, V.M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13354 (INIS-SU—125, pp 252) **Change of conversion factors of E3-transition in sup(235m)U at population variations of uranium atom shell valent zone orbits.** Grechukhin, D.P.; Soldatov, A.A. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

6530 Nuclear Theory

REFER ALSO TO CITATION(S) 13286, 13286, 13306, 13338

13355 **(DOE/ER/40048—21-L2) Parity-nonconserving nuclear forces.** Adelberger, E.G. (Washington Univ., Seattle (USA). Dept. of Physics; Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.)). 1982. Contract AC06-81ER40048. 18p. NTIS, PC A02/MF A01. Order Number DE83004922.

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Recent experimental and theoretical progress in studies of the parity-non-conserving weak NN force is described. Emphasis is placed on results from the two-nucleon system and from simple parity-mixed doublets in light nuclei.

13356 (INIS-SU—125, pp 141) **Taking into account the Pauli principle in description of odd deformed nuclei states.** Solov'ev, V.G.; Nesterenko, V.O.; Bastrukov, S.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13357 (INIS-SU—125, pp 152) **Determination of the core inertial characteristics according to the data on the aligned angular moment of the octupole bands.** Brianson, Sh.I.; Mikhajlov, I.N.; Safarov, R.Kh.; Usmanov, F.M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13358 (INIS-SU—125, pp 155) **Usage of the sum rules for a systematics of the analog and Gamow-Teller resonances in the self-consistent theory of the finite Fermi systems.** Tolokonnikov, S.V.; Fayans, S.A. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13359 (INIS-SU—125, pp 164) **Meson theory of the nuclear forces.** Kozhamkulov, T.A.; Murzagaliev, G.D. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13360 (INIS-SU—125, pp 165) **Relativistic effects in a nucleus and nuclear forces and models.** Krutov, V.A. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13361 (INIS-SU—125, pp 170) **Collective excitations of nuclear matter in the adiabatic time- dependent Hartree-Fock theory.** Barts, B.I.; Bolotin, Yu.L.; Kazarinov, M.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13362 (INIS-SU—125, pp 197) **Generating invariants of Sp(6, R) model.** Filippov, G.F.; Tereshin, Yu.V.; Vasilevskij, V.S. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13363 (INIS-SU—125, pp 200) **Evaluation of the sd-nucleus level density in the framework of exactly solved model with strongly limited dynamics.** Vanagas, V.V.; Sabalyauskas, L.Yu.; Ehriksonas, K.M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13364 (INIS-SU—125, pp 201) **Corrections to nuclear hydrodymamics, due to dynamical deformation of the Fermi surface.** Kolomiets, V.M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13365 (INIS-SU—125, pp 202) **Nonlinear response and collective motion in nuclei at large amplitudes in time-dependent Hartree-Fock approximation.** Kolomiets, V.M.; Nil'ssov, B.; Prakash, M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13366 (INIS-SU—125, pp 213) **Effect of zero collective oscillations on observed nuclear properties.** Masterov, V.S.; Rabotnov, N.S. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13367 (INIS-SU—125, pp 214) **Taking into account proton-neutron symmetry in the framework of interacting boson model.** Efimov, A.D.; Mikhajlov, V.M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13368 (INIS-SU—125, pp 218) **Coulomb and total energies of light nuclei.** Kolesnikov, N.N.; Badaev, O.P.; Starosotnikov, M.I. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13369 (INIS-SU—125, pp 241) **Description of rotation using of collective bosons with Ksup(π)=Isup(+) momentum projection.** Mikhajlov, V.M.; Panin, R.B. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13370 (INIS-SU—125, pp 244) **Photon-nucleus interaction at the energies below the photonuclear reaction threshold.** Piskarev, I.M. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13371 (INIS-SU—125, pp 389) **Non-Born methods in the direct nuclear reaction theory.** Kukulin, V.I.; Neudachin, V.G. 1982. (In Russian). NTIS (US Sales Only), PC A25/MF A01.

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

13372 (PNL-SA—9950, pp 43-45) **Portable instrumentation for processing information from selected personnel neutron dosimetry detectors.** Buchanan, R.J. (Los Alamos National Lab., NM). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

The application of experimental, real-time neutron detectors to measure neutron dose equivalent is discussed. Emphasis is on interfacing the detectors to microcomputer-based portable instruments. This consists of selecting the appropriate neutron detector, determining its operating characteristics and the information it can provide, interfacing this information with a data storage bank, manipulating the data to obtain the neutron dose equivalent, and then providing a read-out in a useful format. (KRM)

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 12342, 12342

13373 (ATS-TUH—1081) **Attenuation of photon beams from radionuclides. Pt. 6.** Dorner, R.; Vogt, H.G. (Hannover Univ. (Germany, F.R.). Arbeitsgruppe fuer Technischen Strahlenschutz). Apr 1982. 101p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82750944.

Point kernel shielding calculations have been performed for water for the photons of radioactive nuclides, comprising gamma rays, characteristic X-rays, annihilation photons as well as internal and external bremsstrahlung. The calculations refer to an isotropic point source and an infinite homogeneous medium. The results are presented for 137 radionuclides by tables of dose rate constants and sets of figures of the reciprocal attenuation factor S^{-1}. The shielding curves cover the range of $10^{-9} < S^{-1} < 1$ and water thicknesses up to 340 cm.

13374 (BDX—613-2876) **Neutron-shielding material. Translated from the Japanese.** Maeda, M. (Bendix Corp., Kansas City, MO (USA)). Nov 1982. Contract AC04-76DP00613. 11p. NTIS, PC A02/MF A01. Order Number DE83004126.

A procedure for fabricating neutron-shielding material consisting of 100 weight parts polyethylene resin and 350 to 750 weight parts of inorganic boron compound is described. (WHK)

13375 (INIS-mf—7409, pp 36) **Synchrotron X-ray diffraction from liquid crystals, perfect crystals and perfect liquid crystals.** Als-Nielsen, J. (Risoe National Lab., Roskilde (Denmark)). 1982. (In Danish). NTIS (US Sales Only), PC A03/MF A01.

From 18. Danish crystallographic meeting; Roskilde, Denmark (17 May 1982).

13376 (INIS-SU—122, pp vp) **Method for analysis of averages over transmission energy of resonance neutrons.** Komarov, A.V.; Luk'yanov, A.A. 1981. (In Russian). NTIS (US Sales Only), PC A06/MF A01 06/MF A01.

In Nuclear constants.

Experimental data on transmissions on iron specimens in different energy groups have been analyzed on the basis of an earlier developed theoretical model for the description of resonance neutron averages in transmission energy, as the functions of specimen thickness and mean resonance parameters. The parameter values obtained agree with the corresponding data evaluated in the theory of mean neutron cross sections. The method suggested for the transmission description permits to reproduce experimental results for any thicknesses of specimens.

13377 (JINR-R—9-81-712) **Structure of transition radiation of the electron bunch moving through plane screens.** Dolya, S.N.; Kadantseva, E.P.; Rubin, S.B. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703323.

The "rigid" electron bunch, transversing a gap between the two ideal conducting screens with constant velocity has been studied. It is numerically demonstrated that for a time longer than b/c, where b=bunch transverse dimension, c = light velocity, there exists one-polar electric field between a moving bunch and a screen. The known analytical expressions for the field intensity, possessing sufficiently complicated structure, are reduced to a simpler form. It affords the opportunity of estimating and refining the physical picture of the field propagation.

13378 (UCID—19604) **Summary of measurements and calculations of neutron and gamma-ray emission spectra from spheres pulsed with 14-MeV neutrons.** Hansen, L.F.; Komoto, T.T.; Pohl, B.A.; Wong, C. (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 14p. NTIS, PC A02/MF A01. Order Number DE83004450.

A tabulation of the spherical assemblies for which the transport of 14-MeV neutrons have been measured using pulsed sphere and time-of-flight techniques is presented. The description of the measurements and their comparison with the predictions of LLNL Monte Carlo calculations using the ENDL and ENDF (III to V versions) libraries can be found in the publications listed in the references.

13379 **(UCID—19616) UNSPEC reference manual: 10/29/82 version.** Finn, H.F. (Lawrence Livermore National Lab., CA (USA)). 1 Dec 1982. Contract W-7405-ENG-48. 43p. NTIS, PC A03/MF A01. Order Number DE83004681.

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A new version of UNSPEC is available from the file storage/transport system (in XPORT, issue a RD .275600:UNSPEC:UNSPEC command) which is a replacement for the 2/28/81 version now residing in LLIB1. It was written at the request of the Y-Project Group but remains general enough that it will probably be the version-of-choice for most other users. Its improvements include: corrections in the order of some processing steps; improved graphics; optional extra labeling; an optional blackbody trial spectrum output file; choice of correction algorithms; and improved input formats for blackbody trial spectrum parameters and response functions within the control deck. Except for the last item, all changes are backwards compatible. The supporting documentation has also been revised and expanded.

6550 Medical Physics

REFER ALSO TO CITATION(S) 12959, 12976, 12979, 12988, 12989, 12991, 13165, 13166, 13170

13380 **(DOE/EV/03522—25) Biological and clinical dosimetry. Comprehensive eighteen-year report, July 1, 1964-June 30, 1982.** Laughlin, J.S.; Zeitz, L. (Memorial Sloan-Kettering Cancer Center, New York (USA)). 1 Aug 1982. Contract AC02-76EV03522. 181p. NTIS, PC A09/MF A01. Order Number DE82021625.

Portions of document are illegible.

The objectives are to develop and apply primary and secondary dosimetric systems for measurements in the complex radiation fields currently in use for radiobiological research and advanced radiation oncology. The concept of local absorbed dose calorimetry continues to be applied and further developed using tissue equivalent and other materials. Aspects of a simplified approach to calorimetry with thermistors used as non-isolated-sensors in polystyrene are described. This approach also has the potential of giving accurate absolute absorbed dose measurements in situations where the irradiation time can be limited to about 20 minutes. A non-isolated-sensor calorimeter has also been constructed of A-150 tissue equivalent (TE) plastic. Comparison of the absorbed dose measurements with these two calorimeters, after correction for the known mass energy absorption coefficients, gives a direct determination of the thermal defect of A-150 plastic at different levels of free O_2 content in the material. This will permit a study of various approaches to excluding oxygen. This type of calorimeter is presently also being constructed with solid-water-equivalent plastic, i.e., the material designated WT/SRI by Constantinou. Our previously successful isolated sensor calorimeters are still in operation. With the availability of both isolated and non-isolated absorbed dose calorimeters, of our parallel plate ionization chambers in similar material and geometry, and of specific commercial ion chambers, we are in a unique position not only to compare all of these systems but to examine critically basic assumptions in absorbed dose concepts and the correction factors used in different methodologies.

13381 (FS—79-19-AKD, pp 15-16) **Present state of 'Arbeitskreis Dosismessung' - recommendation on environmental monitoring.** Heinzelmann, M. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

13382 (FS—79-19-AKD, pp 64-67) **Improvement of electrochemical etching technique in neutron dosimetry.** Piesch, E.; Hassib, G.M. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

13383 (FS—79-19-AKD, pp 68-73) **Results of an international comparitive evaluation of neutron dosemeters for personnel monitoring.** Schraube, H. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

Towards the end of the year 1977 and early in 1978, an irradiation programme has been carried out in cooperation with the Commission of the European Communities in order to acquire data for the 'European Neutron Personnel Monitoring Intercomparison Project (EMNIP77)'. Under idealized conditions in a low backscatter environment, neutron personnel monitors of various design have been irradiated in the neutron energy range of 0.5 MeV <= Esub(n) <= 15 MeV with three different dose equivalents of 50 mrem <= H <= 10 rem, the dosemeters being arranged either on a tissue-equivalent phantom or free in air.

13384 (FS—79-19-AKD, pp 78-81) **Relationship of body doses and dose equivalent index in case of external gamma and X-radiation.** Kramer, R. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

13385 (FS—79-19-AKD, pp 82-85) **Investigations in the field of beta-dosimetry.** Regulla, D.F.; Caldas, L. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

13386 (FS—79-19-AKD, pp 87-88) **Secondary calibration standard for the radiation dose of beta radiation in tissue.** Boehm, J. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

13387 (FS—79-19-AKD, pp 92-94) **Determination of skin dose in personnel contamination.** Heinzelmann, M. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

13388 (FS—79-19-AKD, pp 95-101) **Occupational radiation exposure in Austria - results of personnel monitoring using thermoluminescent dosemeters.** Duftschmid, K.E. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

The Institut fuer Strahlenschutz, Seibersdorf, can look back on more than two years of experience with the automated TLD personnel monitoring system for routine control and dose record keeping of currently about 10.000 persons per month. For more than 100.000 entries on monthly received doses have been stored so far in the Master File of the Institute's computer centre. This paper presents a survey of the statistical dose distribution in the various sectors of employment such as industry, research establishments, medical establishments and nuclear facilities, including data on the mean annual doses and the collective doses for the various sectors; information is also given on the number of cases where a dose has been in excess of the set level, and on the measured data. The data stored in the dose record keeping system allow a detailed assessment to be made of the occupational radiation exposure in Austria.

13389 (FS—79-19-AKD, pp 102-107) **Computer-aided dose determination and methods of occupational dose analysis using film.** David, J. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

13390 (FS—79-19-AKD, pp 108-111) **Organizational measures to be taken to enable the official dose records offices to meet the requirements of legislation.** Haid, G. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

The requirements set by the Federal Ministry of the Interior regarding the functions of the official dosimetry and record keeping

system are aimed at coordinating the services of the various dose records offices in order to ensure a high level of efficiency, uniform basic equipment and uniform read-out and assessment methods within the FRG and West Berlin. Another goal pursued is to conceive methods and standardized procedures guaranteeing the required exchange of information between the official dose records offices and the user, the dose records office and the supervisory authority, and between the supervisory authority and the user. For this purpose, the establishment of a central personal dose registry is being envisaged.

13391 (FS—79-19-AKD, pp 112-119) **Current state in the establishment of a central personal dose registry.** Faerber, K.; Nitschke, J. Mar 1979. (In German). Dep. NTIS (US Sales Only).

From 9. meeting of the working group for external radiation dose measurement; Neuherberg, F.R. Germany (30 Nov 1978).

There are currently about 130.000 radiation workers in the FRG who have to be monitored for their radiation exposure in compliance with the Radiation Protection Ordinance and the X-ray Ordinance and who are enrolled in the dosimetry and record-keeping service of five official dose records offices. Dosemeter read-out and dose assessment is carried out on a monthly basis. The decentralization of these services has hitherto impeded a detailed analysis of occupational radiation exposure across the FRG. In order to meet the increasingly urgent demand for effective control not only of the individual dose received by the radiation workers but also of the collective radiation exposure in the FRG', the concept of gathering the information available from the various dose records offices in a central personal dose registry obviously is an adequate means. The Federal Ministry of Health has been appointed to carry out a pilot study on the development and feasibility of a central personal dose registry, together with the Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, (GSF), Munic.

13392 (PNL-SA—8304) **Microdosimetry of 0.5 to 2.0 MeV electron beams.** Braby, L.A.; Roesch, W.C. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1980. Contract AC06-76RL01830. 15p. (CONF-800944—13). NTIS, PC A02/MF A01. Order Number DE83002704.

From 7. symposium on microdosimetry; Oxford, UK (8 Sep 1980).

The energy imparted in microscopic volumes by electron beams with initial energies from 0.5 to 2.0 MeV has been measured at various depths in plastic. The problems associated with measuring energy deposition spectra of low LET radiations are serious, but the potential importance of these measurements in radiation biophysics justifies the effort required to obtain them. Recent results obtained by Goodhead et al. indicate an RBE greater than 2 for 0.3 keV x-rays compared to 250 kV x-rays, and our results with Chlamydomonas reinhardi indicate an RBE of 1.6 for a 1.5 MeV electron beam at a depth of 400 gm/cm^2 in lucite compared to the same beam at the surface. Development of a theory which appears to explain these results in terms of the microscopic distribution of energy deposition has motivated a detailed study of energy deposition spectra for an electron beam attenuated by various thicknesses of lucite. Simulated sites from 0.5 to 1.9 μm in diameter were studied. The values of anti y determined in these single event measurements compare favorably with those calculated from direct measurements of z reported previously. As expected, the means of the distributions increase significantly with increasing depth in an absorber.

13393 (PNL-SA—9950) **Eighth DOE workshop on personnel neutron dosimetry.** (Pacific Northwest Lab., Richland, WA (USA)). Oct 1981. Contract AC06-76RL01830. 206p. (CONF-8106182—). NTIS, PC A10/MF A01. Order Number DE83003653.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

Separate abstracts were prepared for 23 of 28 articles of this proceedings of the DOE Neutron Dosimetry Workshop held in Seattle, Washington in July 1980. Two of the other articles are duplicates of papers already in the data base. The other three papers were comprised of introductory remarks made at the opening of the workshop.

13394 (PNL-SA—9950, pp 5-11) **DOE Neutron Dosimetry Upgrade Program.** Faust, L.G. (Pacific Northwest Lab., Richland, WA). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

Several aspects of the DOE Neutron Dosimetry Upgrade Program are described. Pacific Northwest Laboratory is the lead laboratory for a US DOE funded program to evlauate personnel neutron dosimeters in use at DOE facilities and to develop into prototype dosimeters concepts potentially capable of increasing the level of performance in personnel neutron dosimetry. Currently 12 DOE contractors are involved in an intercomparison program to determine the relative response of their personnel dosimeters to irradiations specified in the revised ANSI N13.11 (draft) standard and selected monoenergetic neutron energies. Several proposals involving new neutron dosimetry concepts are discussed. (KRM)

13395 (PNL-SA—9950, pp 12-18) **Status of current neutron dosimeter performance analyses.** Yoder, R.C.; Endres, G.W.R.; Thorson, M.R. (Pacific Northwest Lab., Richland, WA). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

The Department of Energy (DOE) has undertaken a large program to develop a new neutron dosimetry concepts that offer improvements over current practices. The development efforts are being directed toward providing devices that are suitable as personnel dosimeters. In conjunction with the development projects, performance data are being accumulated for the personnel dosimeters now used by major DOE contractors. These data are to provide a basis for evaluating the new personnel dosimeters under development. The status of gathering the data for current dosimeters is described in this consistent for doses above 80 mrem. This oversvation is not expected to change as the project progresses. (KRM)

13396 (PNL-SA—9950, pp 153-162) **Use of a D_2O moderated Cf-252 source for dosimeter testing and calibrating.** Schwartz, R.B.; Eisenhauer, C.M. (National Bureau of Standards, Washington, DC). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

Many laboratories use moderator assemblies with radioactive neutron sources, in order to produce a softer spectrum. Our goal at NBS was to select a source-moderator combination which would come as close as was pratical to producing a spectrum similar to that found inside a typical power reactor;specifically the spectrum measured at the Alabama Power and Light Reactor. Since completing the moderating assembly, several neutron dosimeters and neutron measuring instruments have been tested. It is the purpose of this paper to present these measurements, compare them with our calculations, and to use these data as background to discuss the use of the moderate source for testing and calibation. (KRM)

13397 (PNL-SA—9950, pp 163-170) **Calculations on neutron dosimetry at the Chalk River Nuclear Laboratory.** Cross, W.G.; Ing, H. (Chalk River Nuclear Labs., Ontario). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

Methods of calculating quality factors for monoenergetic neutrons, doses and dose equivalents produced in a tissue phantom by monoenergetic neutrons, and neutron activation of sodium in phantoms and the human body are presented. A manual of dosimetry for criticality accidents is also described.

13398 (PNL-SA—9950, pp 171-180) **Analysis of neutron room return.** Eisenhauer, C.M.; Schwartz, R.B. (National Bureau of Standards, Washington, DC). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

This paper discusses the effects of scatteredneutrons on the response of an instrument to a point source in a calibration room. If corrections for scattered neutrons can be made with sufficient accuracy, then the corrected response should be dependent only on the

source and detector, and independent of the characteristics of the calibration room. (KRM)

13399 (PNL-SA—9950, pp 192-194) **Spectral and dosimetric characteristics of a moderated-neutron calibration facility.** Ing, H.; Cross, W.G. (Chalk River Nuclear Labs., Ontario). Oct 1981. NTIS, PC A10/MF A01.

From 8. DOE workshop on personnel neutron dosimetry; Louisville, KY, USA (18 Jun 1981).

The US National Bureau of Standards (NBS) has constructed a standard calibration facility for the testing of personnel neutron dosimeters. Preliminary measurements have been made by the NBS staff of the U-235/Np-237 fission ratio for neutrons outside this calibration facility. This paper presents further Monte Carlo calculations to assess the effect on the fission ratio of spectral variations associated with the replacement of the U-235 fission source by a Cf-252 source, the use of the latest nuclear data files in the neutron transport calculations, and better geometric modelling of the calibration facility to include the outer steel shell, the tubes comprising the source holder and the encapsulation of the source itself.

13400 **β and γ-comparative dose estimates on Enewetak Atoll.** Crase, K.W.; Gudiksen, P.H.; Robison, W.L. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Health Physics;* 42: No. 5, 559-564(May 1982).

Enewetak Atoll in the Pacific is used for atmospheric testing of U.S. nuclear weapons. Beta dose and γ-ray exposure measurements were made on two islands of the Enewetak Atoll during July-August 1976 to determine the β and low energy γ-contribution to the total external radiation doses to the returning Marshallese. Measurements were made at numerous locations with thermoluminescent dosimeters (TLD), pressurized ionization chambers, portable NaI detectors, and thin-window pancake GM probes. Results of the TLD measurements with and without a β-attenuator indicate that approx. 29% of the total dose rate at 1 m in air is due to β- or low energy γ-contribution. The contribution at any particular site, however, is reduced by vegetation. Integral 30-yr external shallow dose estimates for future inhabitants were made and compared with external dose estimates of a previous large scale radiological survey. Integral 30-yr shallow external dose estimates are 25-50% higher than whole body estimates. Due to the low penetrating ability of the β's or low energy γ's, however, several remedial actions can be taken to reduce the shallow dose contribution to the total external dose.

13401 **Estimation of the cumulative exposure to uranium mine atmospheres by in vivo measurements of lead-210 in the skull.** Cohen, N. (New York Univ. Medical Center, Tuxedo); Neton, J.W.; Laurer, G.R.; Eisenbud, M.; Pomroy, C. pp 379-382 of Radiation hazards in mining: control, measurement, and medical aspects. Gomez, M. (ed.). New York, NY; American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (1981).

From International conference on radiation hazards in mining: control, measurement, and medical aspects; Golden, CO, USA (4 Oct 1981).

A method for estimating cumulative exposure to uranium mine atmosphere by measurements of lead 210 in the skull is described. At this time, the methodology for performing this assay utilizes three NaI-CsI(T1) detectors arranged around the head in a counting configuration which will minimize the effects of subject motion and non-uniform deposition. In addition, a head phantom has now been constructed which will be sent to various whole-body counting laboratories for intercomparison calibration and measurement. (KRM)

6560 Solid State Physics

REFER ALSO TO CITATION(S) 12664, 12678

13402 **(DOE/ER/10556—92) Effects of triaxial stressing on creep cavitation of grain boundaries.** Sham, T.L.; Needleman, A. (Brown Univ., Providence, RI (USA). Div. of Engineering). Sep 1982. Contract AC02-80ER10556. 31p. NTIS, PC A03/MF A01. Order Number DE83004083.

We investigate the influence of triaxial stressing on the growth of cavities on grain boundaries by the combined processes of plastic creep flow and grain boundary diffusion. The coupling arises from local accommodation of matter on the grain boundary near the cavity tip due to plastic creep deformability of the grains. This has the effect of shortening the diffusion path length on the grain boundary and increasing the cavity volumetric growth rate. An increase in triaxiality is found to accelerate the matter flux flowing from the cavity surfaces onto the grain boundaries and thus increase the cavity volumetric growth rate. This occurs at realizable levels of triaxiality. However, the enhancement in the triaxial stress state does not affect the effective diffusion path length very significantly. A simple formula for the volumetric growth rate of the cavity is suggested and it is found to give a good approximation to the numerically computed results.

13403 **(IS-T—1025) Dynamic Monte Carlo simulation of the one-dimensional Potts model.** Karma, A.S. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 39p. NTIS, PC A03/MF A01. Order Number DE83004867.

Thesis.

Monte Carlo results are presented for a variety of one-dimensional q-state Potts models. Our calculation confirms the expected universal value $z = 2$ for the dynamic scaling exponent. Our results also indicate that an increase in q, at fixed correlation length, drives the dynamics into the scaling regime.

13404 **(LBL—15220) Mathematical representation of size and electronic factors.** Brewer, L. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 7p. (CONF-821107—36). NTIS, PC A02/MF A01. Order Number DE83004182.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

The relative sizes of the atoms and their electronic configurations are important factors in determining the thermodynamic properties of metallic phases. The regular solution model provides for an asymmetric excess Gibbs energy when there is a size difference, but the actual degree of asymmetry does not correspond to crystallographic sizes. This is due in part to the effect of electronic configurations upon the asymmetry of the Gibbs energy. The Hume-Rothery Rules indicate that the bcc, hcp, and ccp structures are associated with characteristic outer-shell electron per atom concentrations. The electronic factors require modification of the usual definition of internal pressure as used in the regular solution theory. Rather than using the energy of vaporization to the ground atomic state, the energy of vaporization to the valence state atom, which has the same electronic configuration as in the condensed state, is a more appropriate measure of the degree of cohesion and the internal pressure. The problems of providing mathematical expressions that accommodate the contributions of internal pressure, electronic factors, and size factors are discussed.

6561 Superconductivity

REFER ALSO TO CITATION(S) 12668, 12696, 12698, 12700, 12714, 12735, 12738

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 12792

13405 **(FERMILAB-CONF—82/67-THY) Integrability, duality, monodromy, and the structure of Bethe's ansatz.** Thacker, H.B. (Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1982. Contract AC02-76CH03000. 36p. (CONF-8208104—1). NTIS, PC A03/MF A01. Order Number DE83004065.

From Recent advanced in field theory and statistical mechanics conference; Les Houches, France (2 Aug 1982).

Portions of document are illegible.

The technology of integrable quantum systems has developed rapidly over the past several years. The confluence of old and new ideas has produced some beautiful mathematical physics and

provided a great deal of insight into the nature of these systems. In spite of all these developments, one central problem remains unsolved: that of calculating correlation functions for general Bethe's ansatz models. In principle, the problem is straightforward - all information relating to correlations is contained in the Bethe wave functions. We only need to calculate the expectation value of a product of field (or spin) operators for an N-body wave function in a box of length L and let $N \rightarrow \infty$ with N/L fixed. The problem is that such a calculation involves a number of terms of order $(N!)^2$, and the simplifications which presumably occur depend on intricate cancallations among these terms which are not well understood. In the 51 years since Bethe wrote down his ansatz, no one has succeeded in getting a complete answer in this way. In these lectures, the problem of calculating correlation functions for integrable models, and some of the possibilities that have been raised by recent developments are discussed.

13406 **(INFN/AE—82/3) Shape of tachyons.** Barut, A.; Maccarrone, G.D.; Recami, E. (Istituto Nazionale di Fisica Nucleare, Catania (Italy)). 14 Jun 1982. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900836.

We study some aspects of the experimental behavior of tachyons, in particular by finding out their apparent shape. A Superluminal particle, which in its own rest-frame is spherical or ellipsodal (and with an infinite life-time), would appear to a laboratory frame as occupying the whole region of space bound by a double cone and a two-sheeted hyperboloid. Such a structure (the tachyon shape) rigidly travels with the speed of the tachyon. However, if the Superluminal particle has a finite life-time in its rest-frame, then in the laboratory frame it gets a finite space-extension. As a by-product, we are able to interpret physically the imaginary units entering - as wellknown - the transversal coordinates in the Superluminal Lorentz transformations. The various particular or limiting cases of the tachyon shape are thoroughly considered. Finally, some brief considerations concerning possible experiments to look for tachyons are added.

13407 **(LA-UR—82-3338) Coherent states with classical motion: from an analytic method complementary to group theory.** Nieto, M.M. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 19p. (CONF-821154—1). NTIS, PC A02/MF A01. Order Number DE83003638.

From Group theoretical methods in physics seminar; Moscow, USSR (24 Nov 1982).

From the motivation of Schroedinger, that of finding states which follow the motion which a classical particle would have in a given potential, we discuss generalizations of the coherent states of the harmonic oscillator. We focus on a method which is the analytic complement to the group theory point of view. It uses a minimum uncertainty formalism as its basis. We discuss the properties and time evolution of these states, always keeping in mind the desire to find quantum states which follow the classical motion.

13408 **(PNL—4580) Estimating tail probabilities.** Carr, D.B.; Tolley, H.D. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 43p. NTIS, PC A03/MF A01. Order Number DE83005241.

This paper investigates procedures for univariate nonparametric estimation of tail probabilities. Extrapolated values for tail probabilities beyond the data are also obtained based on the shape of the density in the tail. Several estimators which use exponential weighting are described. These are compared in a Monte Carlo study to nonweighted estimators, to the empirical cdf, to an integrated kernel, to a Fourier series estimate, to a penalized likelihood estimate and a maximum likelihood estimate. Selected weighted estimators are shown to compare favorably to many of these standard estimators for the sampling distributions investigated.

13409 **(UCRL—88315) Rheology via nonequilibrium molecular dynamics.** Hoover, W.G. (Lawrence Livermore National Lab., CA (USA)). Oct 1982. Contract W-7405-ENG-48. 15p. (CONF-8210114—1). NTIS, PC A02/MF A01. Order Number DE83004302.

From Annual meeting of the Society of Rheology; Evanston, IL, USA (27 Oct 1982).

The equilibrium molecular dynamics formulated by Newton, Lagrange, and Hamilton has been modified in order to simulate rheologial molecular flows with fast computers. This modified Nonequilibrium Molecular Dynamics (NEMD) has been applied to fluid and solid deformations, under both homogeneous and shock conditions, as well as to the transport of heat. The irreversible heating associated with dissipation could be controlled by carrying out isothermal NEMD calculations. The new isothermal NEMD equations of motion are consistent with Gauss' 1829 Least-Constraint principle as well as certain microscopic equilibrium and nonequilibrium statistical formulations due to Gibbs and Boltzmann. Application of isothermal NEMD revealed high-frequency and high-strain-rate behavior for simple fluids which resembled the behavior of polymer solutions and melts at lower frequencies and strain rates. For solids NEMD produces plastic flows consistent with experimental observations at much lower strain rates. The new nonequilibrium methods also suggest novel formulations of thermodynamics in nonequilibrium systems and shed light on the failure of the Principle of Material Frame Indifference.

13410 **Another gravitational instability of flat space-time.** Lapedes, A. (Institute for Advanced Study, Princeton, NJ (USA); Los Alamos Scientific Lab., NM (USA). Theoretical Div.); Mottola, E. (Institute for Advanced Study, Princeton, NJ (USA)). *Physics Letters, [Section] B;* **110**: No. 2, 114-116(25 Mar 1982).

Witten's demonstration of the instability of the five dimensional Kaluza-Klein ground state can be reduced to four, physical dimensions. One can then conclude that flat space-time at zero temperature with one of the spatial directions wrapped up is unstable. The decay rate is of order $\exp(-L^2/16\pi L_{sub(p)}^2)$ where L is the spatial periodicity and Lsub(p) is the Planck length. The post tunnelling evolution of the space-time is also discussed.

13411 **Convergence of reflectionless approximations to confining potentials.** Schonfeld, J.F. (Univ. of Minnesota, Minneapolis); Kwong, W.; Rosner, J.L.; Quigg, C.; Thacker, H.B. *Annals of Physics (New York);* **128**: No. 1, 1-28(Aug 1980).

The construction of reflectionless potentials supporting a prescribed spectrum of Schroedinger bound states is discussed and related to the inverse problem for confining potentials. A simple formula is derived for the Jost solution in a one-dimensional reflectionless potential with N bound sates. This leads to compact expressions for the potential and the bound-state wavefunctions in terms of the bound-state energies. For symmetric potentials, N-fold product formulas are obtained for bound-state wavefunctions and their slopes at the origin. Corresponding quantities in a confining potential are given by infinite products. Comparison of the finite-product and infinite-product expression allows a demonstration of the convergence of the reflectionless results to the confining potential results as $N \rightarrow \infty$. Several sum rules satisfied by the reflectionless potential at the origin are applied to numeric studies of convergence.

13412 **Calculations related to quantum stochasticity, an example of overlapping avoided crossings.** Noid, D.W. (Oak Ridge National Lab., TN); Koszykowski, M.L.; Marcus, R.A. *Chemical Physics Letters;* **73**: No. 2, 269-272(15 Jul 1980).

In plots of eigenvalues of the Shcroedinger equation versus a perturbation parameter, many avoided crossings are found in the classically stochastic regime for the system studied. None was observed in the classically quasi-periodic regime. Overlapping avoided crossings are suggested as a mechanism for making the vibrational wavefunction a statistical one.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 13287, 13403, 13569

13413 **(DOE/ER/03077—176) On a class of high resolution total-variation-stable finite-difference schemes.** Harten, A. (New York Univ., NY (USA). Courant Inst. of Mathematical Sciences). Oct 1982. Contract AC02-76ER03077. 54p. NTIS, PC A04/MF A01. Order Number DE83004386.

This paper presents a class of new explicit and implicit second order accurate finite difference schemes for the computation of weak solutions of hyperbolic conservation laws. These highly nonlinear schemes are obtained by applying a nonoscillatory first order accurate scheme to an appropriately modified flux. The so derived second order accurate schemes achieve high resolution, while retaining the robustness of the original first order accurate scheme.

13414 **(DOE/ER/10841—5) Least absolute deviations regression.** Bloomfield, P. (Princeton Univ., NJ (USA). Dept. of Statistics). 1982. Contract AC02-81ER10841. 11p. (CONF-820763—1). NTIS, PC A02/MF A01. Order Number DE83004424.

From 5. national symposium on probability and statistics; Sao Paulo, Brazil (26 Jul 1982).

Some fast algorithms have recently been constructed for fitting regression equations by the Least Absolute Deviations criterion. The basis for these algorithms is discussed, and the geometry of the problem is described. The difficulties caused by degeneracy of the problem and nonuniqueness of the solutions are also mentioned.

13415 **(GKSS—82/E/4) Numerical solution of partial differential equations of physics. Pt. 2.** Eppel, D.; Haeuser, J.; Tanzer, F. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1982. 117p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82750933.

In chapter 4 criteria for the assessment of numerical procedures are given as well as methods for the investigation of the stability of difference equations. All methods are exemplified by numerical examples. Transport processes as they occur in enviriomental sciences are accounted for. Chapter 5 describes the solution of systems of linear equations, and the storage of large matrices. The various methods, again, are exemplified by numerical examples. Part 1 of this paper was published as GKSS-Report 80/E/14.

13416 **(INIS-mf—7423) Nonlinear nonstationary analysis with the finite element method.** Vaz, L.E. (Stuttgart Univ. (Germany, F.R.)). 26 Feb 1981. 229p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83780179.

Thesis.

In this paper, after some introductory remarks on numerical methods for the integration of initial value problems, the applicability of the finite element method for transient diffusion analysis as well as dynamic and inelastic analysis is discussed, and some examples are presented. (RW).

13417 **(IS-T—1014) Asymptotic formulas for elliptic integrals.** Gustafson, J.L. (Ames Lab., IA (USA)). Dec 1982. Contract W-7405-ENG-82. 73p. NTIS, PC A04/MF A01. Order Number DE83004793.

Portions of document are illegible. Thesis.

Asymptotic formulas are derived for incomplete elliptic integrals of all three kinds when the arguments are real and tend to infinity or to zero. Practical error bounds are found for the asymptotic formulas. Several techniques are used, including a method recently discovered by R. Wong for finding asymptotic expansions with remainder terms for integral transforms. Most of the asymptotic formulas and all of the error bounds appear to be new. We use incomplete elliptic integrals which possess a high degree of permutation symmetry in the function arguments. The asymptotic formulas are applicable to complete elliptic integrals as a special case; some of the error bounds are treated separately in the complete case. Numerical examples are given to demonstrate the typical accuracy which can be expected from the formulas, as well as the closeness of the error bounds.

13418 **Comments on a recent paper by Emery et al.: a comparison of some of the thermal characteristics of finite-element and finite-difference calculations of transient problems.** Gresho, P.M. (Lawrence Livermore Lab., CA). *Numerical Heat Transfer;* 2: 519-520(1979). Contract W-7405-ENG-48.

Emery et al. have advocated the finite-difference method as "the only rigorously effective method of computing short-time solutions" and compared the resulting nonoscillatory results to those obtained by using the finite-element method with the consistent mass (capacitance) matrix, which generates oscillatory solutions (and "overshoot") at small time. It is the purpose of this note to offer an alternative interpretation of this behavior and thereby recommend the opposite conclusion.

70 FUSION ENERGY

7001 Plasma Research

REFER ALSO TO CITATION(S) 11663

13419 **(CONF-821124—12) Velocity-space particle loss in field-reversed configurations.** Hsiao, M.Y.; Miley, G.H. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). 1982. Contract AC02-76ET52040. 4p. (COO—2218-261). NTIS, PC A02/MF A01. Order Number DE83005072.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

Near collisional equilibrium, the particle distribution subjected to a loss boundary in velocity space is obtained. A simple analytic expression is found to be a good approximation for the distribution function. The velocity-space particle loss rate and the corresponding particle confinement time due to like-particle collisions are calculated. The importance of this mechanism is demonstrated by the relatively short <tau/sub p/> prediction.

13420 **(CONF-821124—14) Computational simulation of spheromak plasma heating.** Olson, R.E.; Miley, G.H. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). 1982. Contract AC02-76ET52040. 4p. (COO—2218-263). NTIS, PC A02/MF A01. Order Number DE83002558.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

The examination of spheromak plasma heating provides a logical bridge between the present-day experimental studies of compact torus formation and the futuristic conceptual studies of the spheromak and moving ring reactors. In the near term, the work helps in understanding the temperature clamping in experiments and provides some insight into how to overcome this obstacle (e.g., via impurity cleanup). In the longer term, the work also provides some insight into other possible temperature clamping problems (i.e., soft beta limit and resistive interchange) and allows us to propose and study methods for overcoming them.

13421 **(DOE/ER/53136—2) Theoretical aspects of mirror fusion. Progress report, 1 October 1982-31 December 1982.** Knorr, G.E.; Nicholson, D.R. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Dec 1982. Contract AC02-82ER53136. 8p. NTIS, PC A02/MF A01. Order Number DE83004643.

Summaries of research during this period are given for the following: (1) streaming of plasma out of a magnetic mirror; and (2) parametric instabilities during ecr heating of tandem mirrors. (MOW)

13422 **(DOE/ER/53140—5) Monte Carlo studies of tandem-mirror plasmas interacting with waves in the ion-cyclotron range of frequencies (ICRF). Progress report, October 1, 1982-December 31, 1982.** Todd, A.M.M. (Grumman Aerospace Corp., Princeton, NJ (USA)). Jan 1983. Contract AC02-82ER53140. 4p. NTIS, PC A02/MF A01. Order Number DE83005090.

A parameter survey of ICRF Start-up of Tandem Mirrors has been completed. Typical results of this study include finding no significant difference in performance between inboard and outboard antennas, and an optimum ratio of the central cell electron to ion temperature of between one and two. Comparison with PHAEDRUS is good, differences being attributable to the radial variation in the experiment, and the absence of charge exchange in the simulation. We have begun RF fueling calculations for MARS and find agreement with LLNL power estimates. However, the error bars on these calculations are very large and variance reduction is required to generate credible values. Zero banana width calculations for PLT have also been started, but again, the scatter in the results is large and new techniques will have to be developed.

13423 **(DOE/ET/51013—59) Role of radiation on the power balance of the Alcator C tokamak.** Pickrell, M.M. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Nov 1982. Contract AC02-78ET51013. 242p. (PFC/RR—82-30). NTIS, PC A11/MF A01. Order Number DE83005441.

Portions of document are illegible. Thesis.

The radiation from the Alcator C tokamak plasma was measured with a 16- element, collimated, bolometer array and a single-element bolometer flush with the vacuum-chamber wall. In the low-density regime, anti n/sub e/ $\leqq 2 \times 10^{14}$ cm^{-3}, and with molybdenum limiters, radiation dominated the power balance, accounting for more than half the ohmic input, and occasionally collapsing the temperature profile into a hollow shape. The source of the radiation was molybdenum line emission. At high densities, central emission became negligible, (i.e., less than 10% of the central ohmic input). However, an enhanced emission region developed on the upper inside edge of the plasma. This region, called a marfe, radiated strongly at wavelengths corresponding to low-temperature processes, such as H/sub α/ and Carbon III emission. The total power lost was comparable to the rest of the plasma.

13424 **(INIS-mf—7433) Research report 1980.** (Stuttgart Univ. (Germany, F.R.). Inst. fuer Plasmaforschung). 1980. 19p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83780184.

In this annual report results are presented in the fields of radio frequency heating, belt pinch, laser applications, and plasma focus. See hints under relevant topics. In addition a list is presented showing all publications, conference reports, dissertations, diploma and half-year reports, laboratory reports, and all invited talks. (GG).

13425 (INIS-mf—7433, pp v) **Wave and plasma heating.** Raeuchle, E.; Erz, U.; Janzen, G.; Moser, F.; Schueller, P.G.; Weixelbaum, K. 1980. (In German). Dep. NTIS (US Sales Only).

In Research report 1980.

In the field of wave heating absorption studies of plasma magnetic waves in the theta pinch are extended to axially inhomogeneous waves. In the Plasmaus 4 experiment direct plasma production has been accomplished for overcritical densities and high magnetic fields. The numerical methods developed at IPF for plasma simulation studies have been applied successfully to further problems. (orig./GG).

13426 (INIS-mf—7433, pp v) **HECTOR, a high voltage belt pinch experiment.** Wilhelm, R.; Erckmann, V.; Mueller, G.; Singethan, J.; Thumm, M. 1980. (In German). Dep. NTIS (US Sales Only).

In Research report 1980.

With the belt pinch experiment HECTOR equilibrium and transport studies have been started for low particle densities, and first results have been obtained also with respect to neutron production during shock-wave heating and wave excitation in the post implosion phase. (orig./GG).

13427 (INIS-mf—7433, pp v) **Laser applications.** Salzmann, H.; Bitzenberger, B.; Dodel, G.; Hailer, H.; Heppner, J.; Hirsch, K.; Holzhauer, E.; Kasparek, W.; Mayerhoffer, K.; Schulze, G. 1980. (In German). Dep. NTIS (US Sales Only).

In Research report 1980.

In the field of laser applications first measurements have been performed at ASDEX of periodically pulsed scattering, mainly to obtain more information on the detector characteristics. The JET-design-study for quasi-stationary scattering has been modified in a way that the time development of the radial distribution of the electron temperature and electron density can be measured too. In addition a method with a better spacial resolution for IR forward scattering measurement has been tested successfully in a demonstration experiment, and the purity of the frequency modes of FIR-lasers could be improved. (orig./GG).

13428 (INIS-mf—7433, pp v) **Plasmafocus.** Deutsch, R. (Innsbruck Univ. (Austria). Inst. fuer Theoretische Physik); Sadowski, M. (Institute of Nuclear Research, Warsaw (Poland)); Herold, H.; Bertalot, L.; Imam, A.; Jaeger, U.; Kaeppeler, H.J.; Lepper, F.; Mozer, A.; Oppenlaender, T. 1980. (In German). Dep. NTIS (US Sales Only).

In Research report 1980.

In the field of plasmafocus experiments the set-up of the 500 kJ experiment DPF 500 has been finished and brought into operation with the first discharges. In other experiments, studies have been performed on plasma dynamics, the localisation of the neutron emission, the time development of the electron temperature distribution as well as theoretical studies on the appearance of microinstabilities. (orig./GG).

13429 **(INIS-mf—7434) Research report 1979.** (Stuttgart Univ. (Germany, F.R.). Inst. fuer Plasmaforschung). 1979. 39p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83780185.

In this annual report results are presented in the fields of radiofrequency heating, belt pinch, laser applications, and plasma focus. See hints under relevant topics. In addition a list is presented showing all publications, conference reports, dissertations, diploma and half-years reports, laboratory reports and all invited talks. (GG).

13430 (INIS-mf—7434, pp v) **Waves and plasmaheating.** McCarthy, A.L. (Adelaide Univ. (Australia)); Niimura, M. (Universidade Estadual de Campinas (Brazil)); Raeuchle, E.; Erz, U.; Janzen, G.; Moser, F.; Schueller, P.G. 1979. (In German). NTIS (US Sales Only), PC A03/MF A01.

In Research report 1979.

In the field of wave heating absorption studies of m=0, k=0 type plasma-magnetic waves have been finished in the Plasmaus 3 theta pinch experiment and preparations are made to extend these studies to other wave modes. In the Plasmaus 4 experiment the production of the initial plasma by electron cyclotron resonance has been extended and improved. (orig./GG).

13431 (INIS-mf—7434, pp v) **HECTOR experiment (high voltage belt pinch).** Wilhelm, R.; Erckmann, V.; Konle, W.; Mueller, G.; Thumm, M. 1979. (In German). NTIS (US Sales Only), PC A03/MF A01.

In Research report 1979.

After final test measurements and further improvements of the preionisation system, the belt pinch experiment HECTOR has been put into operation. In this set-up the plasma is transformed into a toroidal equilibrium using a crow-bar system.

13432 (INIS-mf—7434, pp v) **Laser applications.** Salzmann, H.; Behn, R.; Bitzenberger, B.; Chang, C.H.; Dodel, G.; Douglas, N.; Hailer, H.; Hirsch, K.; Holzhauer, E.; Kasparek, W. 1979. (In German). NTIS (US Sales Only), PC A03/MF A01.

In Research report 1979.

In the field of laser applications the method of CO_2-forward scattering has been used in the INTEREX experiment of the Institut of Plasma Physics (IPP) to measure over-thermal fluctuations. These studies have been finished in cooperation with IPP. After find tests the periodically spiking ruby-laser-system has been used at IPP in the PULSATOR experiment. For the time-resolved scattering, in addition to preparations for a scattering experiment with ASDEX, a design study for JET has been worked out in cooperation with IPP. (orig./GG).

13433 **(INIS-mf—7454) Light scattering measurements on plasma focus.** Kirchesch, P. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Angewandte Physik). Nov 1981. 97p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780186.

In this paper an experimental light-scattering set-up is described, which allows to perform integral and differential spectral measurements in a plasma focus. These two methods are applied for the first time simultaneously in a plasma focus. As a result it could be demonstrated, that electron temperatures can also be obtained from integral measurements, if several observation channels are used. The time- and space resolved measurements of the plasma parameters (density and temperature) show, that thermal neutron production can be neglected for the plasma focus under study. The maximum values for electron focus under study, The maximum values for electron density; electron temperature and ion temperature are: nsub(e) = 4 x 10^{18} cm^{-3}, tsub(e) = 1 keV, Tsub(i) = 1 keV. The set in of micro-turbulences has also been studied in a time and space resolved way. (orig.).

13434 **(INIS-mf—7457) Investigation of transport processes in the wall zone of helium plasma by means of spectroscopical methods.** Eng Kie Souw. (Duesseldorf Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 11 Feb 1981. 155p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83780187.

Thesis.

The major aim of this work is to study the influence of plasma-wall interactions on the velocity distribution of neutral particles. In addition some novel diagnostic methods are tested to investigate the plasma-wall region, and the possible application of these methods in Tokamak systems is considered. Besides current spectroscopic methods, in this experimental study also resonance scattering and fast-resonance scattering methods with a pulsed dye-laser are applied. In contrast to the classical spectroscopic methods, where specially resolved information can be obtained only with some difficulty, the method of laser scattering is well suited to measure local quantities. (orig./HT).

13435 **(INIS-SU—104) Neutron physics. Pt. 4.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow; AN SSSR, Moscow; AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1980. 371p. (In Russian). (CONF-8009198—Pt.4). NTIS (US Sales Only), PC A16/MF A01. Order Number DE83780217.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Abstracts for each paper were entered into the data base. (MOW)

13436 **(IPP—4/205) Self consistent loop antenna theory.** Puri, S. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Feb 1982. 43p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82750937.

An analytic theory of idealized finite loop antennas with an arbitrary current distribution is formulated. Computational steps required for the determination of the antenna current consistent with the perfectly conducting antenna surface are outlined. After dealing with the isolated antenna in free space, the effects due to the Faraday shield, the wall and the plasma are introduced. In the final form of the results, all the necessary antenna parameters may be obtained provided that the plasma surface impedance is known. The concept of the Cross-Fin Antenna which combines the twin function of wave launching and Faraday shielding in a single composite structure is introduced.

13437 **(LA-UR—82-3289) Spectroscopic studies of impurity control in coaxial sources for spheromaks at Los Alamos.** Hoida, H.W.; Barnes, C.W.; Henins, I.; Jarboe, T.R.; Knox, S.O.; Marshall, J.; Platts, D.A.; Sherwood, A.R. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 6p. (CONF-821124—7). NTIS, PC A02/MF A01. Order Number DE83003568.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

Portions of document are illegible.

Spectroscopic measurements have been made of impurity radiation from coaxial sources used to produce spheromaks at Los Alamos. Some of these measurements were viewing the interelectrode region of the source. They show Doppler shifts implying impurity transport for low-Z impurities but not for metallic impurities. In others the relative emission of various lines from the spheromak in the VUV, quartz UV, and optical spectral regions are compared for various source operating parameters. Evidence for the control of impurity production is presented, and a descriptive model is proposed which explains aspects of the transport of impurities from the source into the spheromak.

13438 **(LA-UR—82-3290) Current results from the Los Alamos CTX spheromak.** Barnes, C.W.; Henins, I.; Hoida, H.W.; Jarboe, T.R.; Knox, S.O.; Linford, R.K.; Platts, D.A.; Sherwood, A.R. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 7p. (CONF-821124—8). NTIS, PC A02/MF A01. Order Number DE83003569.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

Continued discharge cleaning, improved vacuum practices, and optimized plasma formation operation have resulted in the CTX experiment achieving 1-ms plasma lifetimes with average temperatures of 20 to 40 eV. The major advance in operation has been the use of 5 to 20 mTorr H_2 gas fill. A multipoint Thomson scattering diagnostic with 12 radial positions yields radial profiles of temperature and densities, an example of which is shown. Local β's can be determined from the measured pressure profile, and average values are typically 15 to 20%. In clean, long-lived discharges the density decreases at a more rapid rate than the magnetic field, until it reaches a value around 2 to 4 x 10^{13} cm^{-3} where it remains constant. This is in contrast to the colder, radiation-dominated behavior, and is taken as evidence that the plasma β is a limit to current operation in CTX.

13439 **(LA-UR—82-3317) Spheromak ICRF heating studies at low power.** Wright, B.L. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 6p. (CONF-821124—9). NTIS, PC A02/MF A01. Order Number DE83003575.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

The potential for rf heating in the CTX spheromak plasma is being examined in our prototype gun facility. The antenna consists of two 180° arcs of copper wire in a quartz envelope encircling the compact torus at its midplane. A 1-cm gap separates the antenna from the flux conserver wall. Magnetic probe coils located on the wall monitor the rf magnetic field. A 100-W source is used to drive the antenna segments at 0° or 180° phase difference in a tank circuit configuration. During a plasma shot, the poloidal magnetic field at the flux conserver wall stabilizes at ~ 1.2 kG and then decays over an interval of 250 μs. At a frequency of 1 MHz the loading of the antenna by the plasma remains fairly constant (~ 1.0 ohm) throughout the entire shot. Signals from magnetic probes 15 cm from the antenna show strong stochastic modulation of the rf amplitude on a time scale of 10 to 20 μs.

13440 **(LA-UR—82-3323) Zero-dimensional model for field-reversed configurations.** Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 5p. (CONF-821124—10). NTIS, PC A02/MF A01. Order Number DE83003540.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

A 0-D model has been developed to study energy, particle, and internal flux confinement during the equilibrium phase in field-reversed configurations (FRC's). Earlier work has been extended to include: (1) a 1-D radial equilibrium pressure profile consistent with particle transport calculations; (2) a time-dependent treatment of impurity radiation losses; (3) a more consistent treatment of ohmic

power. The 0-D model is described. Example numerical solutions are presented.

13441 **(LA-UR—82-3324) FRC confinement studies in FRX-C.** McKenna, K.F.; Armstrong, W.T.; Bartsch, R.R. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 5p. (CONF-821124—11). NTIS, PC A02/MF A01. Order Number DE83003537.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

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The measured particle containment times of up to 190 μs in FRX-C correspond to R^2 scaling and agree with predictions based on lower-hybrid cross-field diffusion. Further improvement in confinement may be possible by translating a field-reversed configuration (FRC) in such a way as to increase x/sub s/.

13442 **(LA-UR—82-3380) Adiabatic compression of elongated field-reversed configurations.** Spencer, R.L.; Tuszewski, M.; Linford, R.K. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 5p. (CONF-821124—6). NTIS, PC A02/MF A01. Order Number DE83003533.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

Portions of document are illegible.

The simplest model of plasma dynamics is the adiabatic model. In this model the plasma is assumed to be in MHD equilibrium at each instant of time. The equilibria are connected by the requirement that they all have the same entropy per unit flux, i.e., the equilibria form a sequence generated by adiabatic changes. The standard way of computing such a sequence of equilibria was developed by Grad, but its practical use requires a fairly complicated code. It would be helpful if approximately the same results could be gotten either with a much simpler code or by analytical techniques. In Sec. II a one-dimensional equilibrium code is described and its results are checked against a two-dimensional equilibrium code; in Sec. III an even simpler analytic calculation is presented.

13443 **(LBL—14464) Design philosophy for high-resolution rate and throughput spectroscopy systems.** Goulding, F.S.; Landis, D.A.; Madden, N.W. (Lawrence Berkeley Lab., CA (USA)). May 1982. Contract AC03-76SF00098. 11p. (CONF-821011—29). NTIS, PC A02/MF A01. Order Number DE83004117.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

Portions of document are illegible.

The paper describes the philosophy behind the design of a pulse processing system used in a semiconductor detector x-ray spectrometer to be used for plasma diagnostics at the Princeton TFTR facility. This application presents the unusual problems of very high counting rates and a high-energy neutron background while still requiring excellent resolution. To meet these requirements three specific new advances are included in the design: (i) A symmetrical triangular pulse shape is employed in the main pulse-processing channel. A new simple method of generating a close approximation to the symmetrical triangle has been developed. (ii) To cope with the very wide dynamic range of signals while maintaining a constant fast resolving time, approximately symmetical triangular pulse shaping is also used in the fast pulse pile-up inspection channel. (iii) The demand for high throughput has resulted in a re-examination of the operation of pile-up rejectors and pulse stretchers. As a result a technique has been developed that, for a given total pulse shaping time, permits approximately a 40% increase in throughput in the system. Performance results obtained using the new techniques are presented.

13444 **(ORNL/TM—8106) Communications interface for the PDP-11 and the Nuclear Data 6600.** Young, K.G.; Greenwood, D.E.; Burris, R.D. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE83005152.

A communications interface has been designed to send data from the Nuclear Data 6600(ND6600), a computer-based multichannel analyzer, to a PDP-11/34, operating under RSX-11M. The hardware consists of a Nuclear Data Serial Communications Processor (SCP) and a CAMAC Kinetics Systems 3340 communications interface. On the PDP-11, Digital Data Communications Message Protocol (DDCMP) software was written to check and reply to each data buffer. The PDP-11 code also saves the data on disk and interfaces with existing communications software. On the Nuclear Data, the DDCMP is contained in firmware on the SCP board. Software was written to retrieve data from disk and to interface with the system software that accesses the SCP board.

13445 **(ORNL/TM—8107) ND6600 computer in fusion-energy research.** Young, K.G. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 66p. NTIS, PC A04/MF A01. Order Number DE83005160.

The ND6600, a computer-based multichannel analyzer with eight ADCs, is used to acquire x-ray data. This manual introduces a user to the Nuclear Data system and contains the information necessary for the user to acquire, display, and record data. The manual also guides the programmer in the hardware and software maintenance of the system.

13446 **(PPPL—1951) Diagnostics for neutral-beam-heated tokamaks.** Goldston, R.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1982. Contract AC02-76CH03073. 50p. NTIS, PC A03/MF A01. Order Number DE83005049.

Diagnostic techniques for neutral-beam-heated tokamak plasmas fall into three categories: (1) magnetic diagnostics for measurements of gross stored energy, (2) profile diagnostics for measurements of stored thermal and beam energy, impurity content and plasma rotation, and (3) fast time resolution diagnostics to study MHD fluctuations and micro-turbulence.

13447 **(PPPL—1961) Radio-frequency wave trajectories for current drive in tokamak reactors.** Wong, K.L.; Ono, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1982. Contract AC02-76CH03073. 30p. NTIS, PC A03/MF A01. Order Number DE83005051.

Detailed ray tracing calculations were carried out for three modes of waveguide-launched radio-frequency waves for tokamak reactor parameters to evaluate their applicability for steady state current drive. The merits and demerits of each mode are discussed.

13448 **(PPPL—1962) Nuclear diagnostic for fast alpha particles.** Grisham, L.R.; Post, D.E.; Dawson, J.M. (Princeton Univ., NJ (USA). Plasma Physics Lab.; California Univ., Los Angeles (USA)). Dec 1982. Contract AC02-76CH03073. 13p. NTIS, PC A02/MF A01. Order Number DE83005052.

We investigate the possibility of seeding a fusion plasma with nuclei which can undergo nuclear reactions with energetic alpha particles to produce product nuclei which are radioactive. If a fraction of these product nuclei can be collected and measured, one can obtain information about the presence of fast alpha particles. It appears that a feasible diagnostic could be based upon the $^{10}B(\alpha,n)^{13}N$ reaction.

13449 **(PPPL—1964) High-beta experiments with neutral-beam injection on PDX.** Johnson, D.; Bell, M.; Bitter, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jan 1983. Contract AC02-76CH03073. 32p. NTIS, PC A03/MF A01. Order Number DE83004838.

We report experimental investigations of high-beta plasmas produced in PDX with near perpendicular neutral-beam injection. Systematic power scans have been performed over a wide range of toroidal fields (0.7T < B/sub T/ < 2.2T) and plasma currents (200 kA < I/sub p/ < 500 kA). At high toroidal fields, the change in total stored energy due to beam injection increases linearly with input power and also increases with plasma current. At lower toroidal fields and low injection-power levels, the stored energy also increases with power and plasma current. However, at high power and low toroidal fields, a saturation in heating is observed. This result suggests the onset of a β/sub T/ limit for circular cross-sectional tokamaks with near-perpendicular injection. Scaling experi-

ments indicate that this β/sub T/ limit increases with rising (1/q). Values of β/sub T/ $\approx$ 3% at q/sub Psi/ = 1.8 have been achieved.

13450 **(PPPL—1966) Alpha-particle simulation and diagnostics using $_3He^{++}$ minority ICRF heating.** Post, D.; Hwang, D.; Mikkelsen, D.; Seidl, F. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1982. Contract AC02-76CH03073. 20p. NTIS, PC A02/MF A01. Order Number DE83004886.

We have investigated the theoretical feasibility of using fast $_3He^{++}$ ions, produced by ICRF minority heating, to simulate the behavior of fusion-produced $_4He^{++}$ ions in large fusion experiments. This proposed technique would allow the study of alpha-particle-like heating in near-term experiments, such as TFTR, JET, and JT-60, without the necessity of high levels of neutron production and the subsequent activation. The results of our calculations study show that ICRF minority heating should be able to produce confined fast $_3He^{++}$ distributions in TFTR-sized experiments with an energy distribution and density similar to those expected for fast alpha particles in fusion-reactor experiments, such as INTOR/FED/NET.

13451 (UCRL—52000-82-11, pp 24-33) **Understanding tandem mirror devices.** Nov 1982. NTIS, PC A03/MF A01.

In Energy and technology review.

Four areas of theoretical plasma physics that affect the design of tandem mirror devices are discussed. From calculations of magnetohydrodynamic equilibrium and radial transport, we learn how to design a magnetic coil set in which a plasma can be produced. From magnetohydrodynamic stability theory, we determine the maximum pressure at which we can confine the plasma. From Fokker-Planck calculations, we gain detailed knowledge of the particle distributions in position and velocity space that result from various particle and energy injection strategies. Using microstability theory, we identify those distributions that are less susceptible to the growth of large-amplitude waves that would degrade the particle confinement times as determined by radial-transport and Fokker-Planck calculations.

13452 **(UCRL—87491) ZAPP: Z-pinch atomic physics program.** Reed, K. (Lawrence Livermore National Lab., CA (USA)). 7 Jan 1983. Contract W-7405-ENG-48. 27p. (CONF-820496—1). NTIS, PC A03/MF A01. Order Number DE83005390.

From 9. conference of the National Society of Black Physicists scientific lectures; Baton Rouge, LA, USA (29 Apr 1982).

High-density and high-temperature plasmas have been produced in a z-pinch with a hollow gas puff. A number of interesting atomic-physics phenomena occur in these plasmas and some of these phenomena provide important diagnostic information for characterizing the plasmas. We have been interested in collisions of high-energy electrons with highly stripped ions in these plasmas. Such collisions may produce a population inversion which could result in stimulated emission in the x-ray regime.

13453 **Linear theory of electromagnetic instabilities in plasmas with a hollow q-profile.** Mahajan, S.M.; Hazeltine, R.D. (Texas Univ., Austin (USA). Fusion Research Center). *Nuclear Fusion;* **22**: No. 9, 1191-1197(Sep 1982).

Electromagnetic instabilities in a plasma with a hollow q-profile are investigated. The tearing mode is found to be unstable even in the absence of external driving magnetic energy and can manifest itself either as the 'binary-tearing' mode with two peaks near the rational surfaces or as the 'centred' mode. The centred mode has no classical analogue and a higher growth rate than the 'double-tearing' limit. The double-tearing mode of Pritchett et al. is a special case of a binary-tearing mode.

13454 **Reply to Comments by W.N. Hugrass on the paper by N.J. Fisch, T. Watanabe "Field reversal by rotating waves" (Nucl. Fusion 22 (1982) 423).** Fisch, N.J.; Watanabe, T. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* **22**: No. 9, 1243-1244(Sep 1982).

13455 **Plasma surface interactions in controlled fusion devices. Report on the fifth international conference, Gatlinburg, Tennessee, United States of America, 3-7 May 1982.** Cohen, S.A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* **22**: No. 8, 1113-1117(Aug 1982).

This paper reviews briefly the main topics presented at the Fifth International Conference on Plasma Surface Interactions in Controlled Fusion Devices, held at Gatlinburg, Tennessee (USA) on 3-7 May 1982. The subject of greatest interest was hydrogen isotope re-cycling. This broad category comprises hydrogen isotope backscattering, fuelling, trapping, diffusion, solubility, recombination, and tritium inventory. Other topics of major interest included limiter design and operation, divertor operation, probe measurements, and plasma diagnostics.

13456 **The status of reversed-field pinch experiments.** Baker, D.A. (Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, NM 87545). *Transactions of the American Nuclear Society;* **41**: 165(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13457 **Relaxation oscillations in a bounded magnetized plasma.** Daniels, S.W.; Bacon, M.E. (Swarthmore Coll., PA (USA). Dept. of Physics). *Plasma Physics;* **24**: No. 2, 167-175(Feb 1982).

Low frequency modulation of the transmitted and reflected microwave power from a thin plasma disc is observed. The plasma is produced by electron cyclotron resonance (ECR) and is sustained in a steady state by absorption at the upper hybrid frequency. Adjustment of the input power and the magnetic field initiates a superimposed oscillating absorption process. The electron density and/or temperature is found to oscillate at the same frequency which is found to fit the simple ion acoustic dispersion relation f=csub(s)/lambda where csub(s)=(kTsub(e)/msub(i))sup(1/2). Since a number of other experiments in entirely different geometry exhibit what appears to be the same phenomena, the occurrence of these relaxation oscillations in microwave plasma interactions would seem to be fairly common.

13458 **Classical transport coefficients in a field-reversed configuration.** Nguyen, K.; Kammash, T. (Michigan Univ., Ann Arbor (USA)). *Plasma Physics;* **24**: No. 2, 177-183(Feb 1982).

A Hill's Vortex equilibrium model is utilized to calculate the classical transport properties of a plasma confined in a field-reversed magnetic configuration. Consistent with zero dimensional steady state conservation of particles and energy the corresponding fluxes at the separatrix are computed using volume-averaged values for the density and conductivity. It is found that the confinement times scale directly with the size of the Vortex and conductivity at that point, and inversely with a function of the profile parameter.

13459 **Steady state linear machine for collisionless plasma studies.** Navratil, G.A.; Slough, J.; Sen, A.K. (Columbia Univ., New York (USA). Plasma Physics Lab.). *Plasma Physics;* **24**: No. 2, 185-196(Feb 1982).

A new linear, steady state machine for the production of a quiescent, magnetically confined, collisionless hydrogen plasma is described. This new device is particularly well suited for the study of low frequency drift wave type instabilities such as the trapped ion instability. This represents an extension of the parameter space accessible to linear devices and more closely simulates the collisionality and bounce frequency regimes (ν/ωsub(b)<approximately equal to 0.1) of a thermonuclear plasma.

13460 **Perturbative study of the spectrum of large toroidal mode number ideal MHD instabilities.** Antonsen, T.M. Jr.; Ferreira, A.; Ramos, J.J. (Massachusetts Inst. of Tech., Cambridge (USA)). *Plasma Physics;* **24**: No. 2, 197-222(Feb 1982).

Ballooning and radially localised interchange mode growth rates in the vicinity of the magnetic axis of an axisymmetric toroidal configuration, are obtained by applying a multiple scale averaging method to the large mode number ideal MHD dispersion equa-

tions. The nature of the spectrum of these two kinds of instabilities is shown, as well as its behaviour at the transition points between them. The effects of the mode compressibility and parallel inertia are taken into account, and a mode conversion phenomenon between Alfven-like and slow magnetosonic-like disturbances is observed.

13461 **Debye shielding of a moving test charge in plasma.** Wang, C.L.; Joyce, G.; Nicholson, D.R. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). *Journal of Plasma Physics;* **25**: 225-231(Apr 1981).

Equipotential contours for a moving test charge in isotropic Maxwellian plasma are determined numerically for a wide range of test charge speeds.

13462 **Scattering of a particle beam by a non-equilibrium plasma.** Perez, J.D. (Lockheed Missiles and Space Co., Palo Alto, CA (USA). Research Labs.); Payne, G.L. (Lockheed Missiles and Space Co., Palo Alto, CA (USA). Research Labs.; Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). *Plasma Physics;* **23**: No. 3, 211-217(Mar 1981).

A model for treating the interaction between a hot, dense plasma and a charged particle beam including the effects of departures from local thermodynamic equilibrium is applied to the scattering of the beam. Expressions for the angular spread and the deflection of a test-particle beam are derived, and calculations for protons and α's on a gold plasma are presented. It is found that a temperature gradient can cause significant deflection of the beam.

13463 **Rayleigh-Schroedinger perturbation theory for unstable modes of a high-β cylindrical tokamak.** Vahala, G. (College of William and Mary, Williamsburg, VA (USA). Dept. of Physics); Cayton, T.E.; Barnes, D.C. (Los Alamos Scientific Lab., NM (USA)). *Plasma Physics;* **23**: No. 2, 83-88(Feb 1981).

Stability analyses of near theta-pinch equilibria usually entail expansions to calculate leading-order growth rates and eigen functions. Rayleigh-Schroedinger perturbation theory allows immediate evaluation of next-order corrections to the growth rate; this property has not been exploited previously. These next-order corrections yield explicitly different growth rates for the ideal magnetohydrodynamic and isotropic guiding center plasma descriptions of a high-β cylindrical Tokamak.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 12342, 13455, 13459

13464 **(CONF-771132—7) TEXT energy-storage system.** Weldon, W.F.; Rylander, H.G.; Woodson, H.H. (Texas Univ., Austin (USA). Center for Electromechanics). 1977. Contract AS05-77ET52029. 15p. NTIS, PC A02/MF A01. Order Number DE83005099.

From Seminar on energy storage, compression and switching; Canberra, Australia (15 Nov 1977).

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The TEXT Energy Storage System, designed by the Center for Electromechanics (CEM), consists of four 50-MJ, 125-V homopolar generators and their auxiliaries and is designed to power the toroidal and poloidal field coils of TEXT on a two-minute duty cycle. The four 50-MJ generators connected in series were chosen because they represent the minimum cost configuration and also represent a minimal scale up from the successful 5.0-MJ homopolar generator designed, built, and operated by the CEM.

13465 **(CONF-821103—49) Three equipment concepts for the Fusion Engineering Device.** Spampinato, P.T.; Masson, L.S.; Watts, K.D.; Grant, N.R.; Kuban, D.P. (Grumman Aerospace Corp., Bethpage, NY (USA); Idaho National Engineering Lab., Idaho Falls (USA); Oak Ridge National Lab., TN (USA); Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.). 1982. Contract W-7405-ENG-26. 4p. NTIS, PC A02/MF A01. Order Number DE83003454.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Maintenance equipment which is needed to remotely handle fusion device components is being conceptually developed for the Fusion Engineering Design Center. This will test the assumption that these equipment needs can be satisfied by present technology. In addition, the development of equipment conceptual designs will allow for cost estimates which have a much higher degree of certainty. Accurate equipment costs will be useful for assessments which trade off gains in availability as a function of increased investments in maintenance equipment.

13466 **(CONF-821124—13) Burn dynamic experiment based on the field-reversed theta pinch.** Miley, G.H. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). 1982. Contract AC02-76ET52040. 6p. (COO—2218-262). NTIS, PC A02/MF A01. Order Number DE83005071.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

A D-T burn dynamic experiment using a scaled-up field-reversed theta-pinch device is proposed as a first step towards demonstration of a D-^{3}He burn. The feasibility of such an experiment is based on a loss-cone-like confinement scaling plus the use of combined pellet and neutral-beam injection to heat the plasma, build-up its density, and damp the m=2 instability.

13467 **(CONF-821128—2) Heat transport with cold and hot electrons allowing for flux limitation by Shvarts' method.** Shkarofsky, I.P. (MPB Technologies, Inc., Ste-Anne-de-Bellevue, Quebec (Canada)). Oct 1982. Contract AC08-81DP40162. 30p. NTIS, PC A03/MF A01. Order Number DE83003397.

From 24. American Physical Society annual meeting; New Orleans, LA, USA (1 Nov 1982).

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The analysis of Shkarofsky is extended to include a variable degree of collisionality and gradient scale length using the method of Shvarts et al. The perturbed electron velocity distribution is limited in magnitude to the unperturbed part when the former becomes larger than the latter. A Maxwellian distribution is adopted for the hot electrons. For the cold electrons, either a Maxwellian (exp(-v^2/v/sub c/^{2})) or an exp(-v^5/v/sub c/^{5}) variation is used. The heat flow has coefficients proportional to gradients in cold and hot electron density, to gradients in cold and hot electron temperature and the free streaming contribution. These contributions are summed for two sample sets of scale lengths. One set of results shows that in an intermediate range of collisionality, the heat conduction and flux limiter are substantially decreased and the heat flow may even change direction.

13468 **(CONF-821212—Suppl.) Mirror advanced reactor study (MARS).** Henning, C.D.; Logan, B.G.; Carlson, G.A. (Lawrence Livermore National Lab., CA (USA)). 14 Dec 1982. Contract W-7405-ENG-48. 326p. NTIS, PC A15/MF A01. Order Number DE83004806.

From Mirror advanced reactor study meeting; Livermore, CA, USA (6 Dec 1982).

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The agenda for the meeting is as follows: (1) basic Tandem Mirror approach, (2) baseline design, (3) transition and Yin-Yang coils, (4) drift pump physics, (5) drift pump coil, (6) Fokker-Planck analysis, (7) ignition-alpha pumping, (8) neutral beam status, (9) axicell layout, (10) axicell radiation levels, (11) ICRH system, (12) central cell cost optimization, (13) central cell coil design, (14) gridless direct converter, (15) direct converter directions, (16) end cell structure, (17) corrosion-double wall HX, (18) central cell maintenance, (19) radioactivity, (20) PbLi blanket design, and (21) MARS schedule. (MOW)

13469 **(CONF-7710248—1) Pulsed hompolar generator research at the University of Texas at Austin.** Weldon, W.F. (Texas Univ., Austin (USA). Center for Electromechanics). 1977. Contract AS05-77ET52029. 11p. NTIS, PC A02/MF A01. Order Number DE83005221.

From Generators and motors seminar; Wright-Patterson Air Force Base, OH, USA (Oct 1977).

13470 **(CONF-7711157—1) Testing of sliding electrical contacts for homopolar generators.** Brennan, M.; Eliezer, Z.; Weldon, W.F.; Rylander, H.G.; Woodson, H.H. (Texas Univ., Austin (USA). Center for Electromechanics). 1977. Contract AS05-77ET52029. 7p. NTIS, PC A02/MF A01. Order Number DE83005226.

From 24. Holm conference on electrical contacts; Chicago, IL, USA (11 Nov 1977).

Due to the recent interest in homopolar generators as pulsed power supplies, the need has arisen for pulsed brush data on slip rings at high current levels and high surface velocities. Tests were conducted to examine the effect that varying the apparent area of contact has on the coefficient of friction, voltage drop and wear rate. Brush areas from 0.806 cm^2 to 3.23 cm^2 were individually tested at current levels from 0.0 A to 2800 A per brush. Experimental data is presented for a high copper grade of commercially available sintered copper graphite material. The data corroborates the thermal mounding phenomenon described by R.A. Marshall.

13471 **(DOE/DP/40030—4) 1981 inertial fusion research annual technical report.** Solomon, D.E.; Wei, J.L.; Greacen, N.T. (eds.). (KMS Fusion, Inc., Ann Arbor, MI (USA)). 1981. Contract AC08-78DP40030. 241p. NTIS, PC A11/MF A01. Order Number DE83004635.

This annual report consists of the following two topics: (1) target fabrication technology, and (2) fusion experiments. The first section is reported by the following seven areas: (1) characterization, (2) fuel shell technology, (3) polymer technology, (4) lithium foil development, (5) precision etch technology, (6) analytical instrumentation, and (7) target fabrication. The second area is reported by the following topics: (1) experiments, (2) plasma theory, (3) code development and simulation, and (4) lasers and optics. (MOW)

13472 **(DOE/ER/53091—T5) Collisional mechanisms in D^- beam sources for MFE experiments and reactors. Technical progress report, November 1, 1981-October 31, 1982.** Coggiola, M.J.; Peterson, J.R. (SRI International, Menlo Park, CA (USA)). 15 Dec 1982. Contract AT03-80ER53091. 22p. NTIS, PC A02/MF A01. Order Number DE83004105.

This research program is designed to aid the development of D^- beam sources needed for the high energy neutral-beam heating of magnetic fusion energy (MFE) plasmas. Initially, the work was directed to predict the angular scattering in D^- beams produced from D^+ by charge transfer in metal vapors. However, recently it has been redirected to provide information on the mechanisms that govern the behavior of direct extraction D^- ion sources, with immediate emphasis on the very promising Ehlers-Leung source at LBNL. The controlling mechanisms in these sources and some aspects of their behavior are only vaguely understood, and this work is designed to answer recent questions about several of these mechanisms. These results will then be incorporated into a modeling effort at LBL that will support future improvements in source design and operation.

13473 **(DOE/ER/54008—T1) Future engineering needs of magnetic fusion.** (National Research Council, Washington, DC (USA). Committee on Magnetic Fusion). 1982. Contract FG01-82ER54008. 108p. NTIS, PC A06/MF A01. Order Number DE83004216.

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As the investigation of magnetic fusion proceeds from experimentation toward development, it will encounter engineering challenges of considerable complexity. Magnetic fusion, the releasing of energy from controlled nuclear reactions involving certain of the light elements, offers the possibility of a new, multipurpose energy source. One such purpose is the generation of electrical power on a commercial scale. The possibility of such a source of electrical power is attractive for the future to complement, and perhaps ultimately to replace, fossil and uranium fuel resources that may have become costly through scarcity or other constraints. Magnetic fusion may also come to be exploited commercially in uses stemming from the intrinsic characteristics of the thermonuclear reaction, that is to say, inexpensively producing copious, energetic neutrons for a not yet fully imagined spectrum of applications.

13474 **(DOE/ET/51013—62) Numerical modeling of a fast-neutron collimator for the Alcator A fusion device.** Fisher, W.A. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Dec 1982. Contract AC02-78ET51013. 82p. (PFC/RR—82-34). NTIS, PC A05/MF A01. Order Number DE83005238.

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A numerical procedure is developed to analyze neutron collimators used for spatial neutron measurements of plasma neutrons. The procedure is based upon Monte-Carlo methods and uses a standard Monte-Carlo code. The specific developments described herein involve a new approach to represent complex spatial details in a method that is conservative of computer time, retains accuracy and required only modest changes in already-developed Monte-Carlo procedures. The procedure was used to model the Alcator A collimator. The collimator consists of 448 cells and has a measured spatial point source response of 0.7 cm. The numerical procedure successfully predicts this response.

13475 **(DOE/ET/53042—13) Simplifying theorem for analyzing rf antennas with feeders.** Michie, R.B. (Texas Univ., Austin (USA). Fusion Research Center). Sep 1982. Contract AS05-77ET53042. 21p. (FRCR—250). NTIS, PC A02/MF A01. Order Number DE83000160.

An antenna Fourier decomposition for plasma coupling to RF heating antenna using some simplifying polarization conditions is given in the magnetostatic limit for cylindrical geometry. Two sets of orthogonal Fourier modes are used: one set containing no radial currents is chosen which is the usual constant radius, divergence free, surface current set, and the second set containing all the radial feed currents, which is chosen to have θ and z currents at the antenna radius, needs to be calculated. This greatly simplifies the boundary conditions, and eliminates the complications of dealing with radial current components.

13476 **(GA-A—16748) Graphite limiter and armor damage in Doublet III.** McKelvey, T.; Taylor, T.; Trester, P. (General Atomic Co., San Diego, CA (USA); Japan Atomic Energy Research Inst., Tokyo). Sep 1982. Contract AT03-76ET51011;AT03-80SF11512. 9p. (CONF-820948—6). NTIS, PC A02/MF A01. Order Number DE83003218.

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

Graphite coated with TiC has been used extensively in Doublet III for limiters and neutral beam armor. Performance of these components has been superior to that of the metal components previously used. Damage to the coated graphite has occurred and can be classified into three categories: (1) gross failure of the graphite due to thermal stresses induced by the combination of high applied energy fluxes and mechanical restraint, (2) surface failure of the graphite due to runaway electron impingement, and (3) loss of TiC coating due to arcing, sputtering, vaporization and spalling, primarily during plasma disruptions and other abnormal plasma conditions. Design improvements are being continually implemented to minimize this damage and its consequences.

13477 **(GA-A—16784) Mode converters used in the Doublet III ech microwave system.** Moeller, C.P. (General Atomic Co., San Diego, CA (USA)). Jun 1982. Contract AT03-76ET51011. 14p. (CONF-8206142—1). NTIS, PC A02/MF A01. Order Number DE83003213.

From 2. gyrotron conference; Washington, DC, USA (21 Jun 1982).

Waveguide mode converters are used in the 60-GHz, 200-kW plasma-heating system for Doublet III both to convert from the TE_{02} to the more-convenient TE_{01} mode for transmission and to convert from the TE_{01} to the TE_{11} mode to produce a linear polarization at the antenna. Both converters use periodic wall perturbations, the former having circularly symmetric perturbations and the latter periodic curvature (m=1) perturbations. The TE_{02} to TE_{01} converter shows a conversion efficiency of at least 95% (99% predicted) while the TE_{01} to TE_{11} converter has a 90% conversion efficiency (92% predicted). The frequency sensitivity of these devices will be discussed.

13478 **(GA-A—16848) ICRF antenna coupling studies.** Elet, R.S.; Chiu, S.C. (General Atomic Co., San Diego, CA (USA)). Aug 1982. Contract AT03-76ET51011. 43p. NTIS, PC A03/MF A01. Order Number DE83005154.

A computational model is developed to study the coupling characteristics of an ion cyclotron range of frequencies (ICRF) antenna system to a reactor-size fusion plasma.

13479 **(GA-A—16885) Initial wall conditioning in Doublet III.** Jackson, G.L.; Clausing, R.E.; Lietzke, A.F.; Ejima, S.; Emerson, L.C.; Heatherly, L. (Oak Ridge National Lab., TN (USA); General Atomic Co., San Diego, CA (USA); Lawrence Berkeley Lab., CA (USA)). Sep 1982. Contract W-7405-ENG-26;AT03-76ET51011;W-7405-ENG-48. 23p. (CONF-821111—19). NTIS, PC A02/MF A01. Order Number DE83004679.

From 29. national symposium on American Vacuum Society; Baltimore, MD, USA (16 Nov 1982).

The first year of operation of Doublet III, a large noncircular tokamak (R = 1.43 m, a = 0.45 m, B/sub T/ ≦ 2.6 T), was highlighted by the achievement of a plasma current in excess of 2 MA. This is partially attributed to the low Z/sub eff/ discharges accomplished by wall conditioning using low temperature, low power discharge cleaning, accompanied by preconditioning of the wall and by baking. Approximately 500 hours of hydrogen discharge cleaning and 25 hours of oxygen discharge cleaning combined with tokamak plasma operations were required to obtain these low Z/sub eff/ tokamak discharges. During the initial cleanup of the wall, copious quantities (> 100 monolayers) of carbon were removed, ultimately with greatest efficiency by oxygen discharge cleaning. During the conditioning process, monitoring the impurity removal rate with the residual gas analyzer (RGA) provided the most understandable measure of the progress of the cleanup, while an in situ Auger analysis surface diagnostic supplied and operated by ORNL was most useful in identifying the presence of heavy hydrocarbons (oil) and monitoring the transport of limiter materials.

13480 **(GTFR—36) FED-INTOR activity.** Stacey, W.M. Jr.; Abdou, M.A.; Montgomery, D.B.; Rawls, J.M.; Schmidt, J.A.; Shannon, T.E.; Thome, R.J. (Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering and Health Physics). Oct 1982. Contract AS05-78ET52025. 54p. NTIS (US Sales Only). Order Number DE83002778.

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A set of critical technical issues affecting near-term tokamak reactors has been addressed by a broad cross section of the USA fusion community. The results of this work have guided the evolution of an improved concept for a tokamak experimental reactor.

13481 **(HEDL-SA—2692-FP) Defect production in simulated cascades: cascade quenching and short-term annealing.** Heinisch, H.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 1982. Contract AC06-76FF02170. 18p. (CONF-821049—10). NTIS, PC A02/MF A01. Order Number DE83004071.

From TMS/AIME fall meeting; St. Louis, MO, USA (24 Oct 1982).

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Defect production in high energy displacement cascades has been modeled using the computer code MARLOWE to generate the cascades and the stochastic computer code ALSOME to simulate the cascade quenching and short-term annealing of isolated cascades. The quenching is accomplished by using ALSOME with exaggerated values for defect mobilities and critical reaction distanes for recombination and clustering, which are in effect until the number of defect pairs is equal to the value determined from resistivity experiments at 4K. Then normal mobilities and reaction distances are used during short-term annealing to a point representative of Stage III recovery. Effects of cascade interactions at low fluences are also being investigated. The quenching parameter values were empirically determined for 30 keV cascades. The results agree well with experimental information throughout the range from 1 keV to 100 keV. Even after quenching and short-term annealing the high energy cascades behave as a collection of lower energy subcascades and lobes. Cascades generated in a crystal having thermal displacements were found to be in better agreement with experiments after quenching and annealing than those generated in a non-thermal crystal.

13482 **(HEDL-SA—2729S) Remote-handling demonstration tests for the Fusion Materials Irradiation Test (FMIT) Facility.** Shen, E.J.; Hussey, M.W.; Kelly, V.P.; Yount, J.A. (Hanford Engineering Development Lab., Richland, WA (USA)). 1982. Contract AC06-76FF02170. 5p. (CONF-821103—59). NTIS, PC A02/MF A01. Order Number DE83004506.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

The mission of the Fusion Materials Irradiation Test (FMIT) Facility is to create a fusion-like environment for fusion materials development. Crucial to the success of FMIT is the development and testing of remote handling systems required to handle materials specimens and maintenance of the facility. The use of full scale mock-ups for demonstration tests provides the means for proving these systems.

13483 **(HEDL-SA—2747) Fusion-reactor blanket-material safety-compatibility studies.** Jeppson, D.W.; Muhlestein, L.D.; Keough, R.F.; Cohen, S. (Hanford Engineering Development Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76FF02170. 26p. (CONF-821106—20). NTIS, PC A03/MF A01. Order Number DE83004505.

From Annual meeting of heat transfer and energy conversion; Los Angeles, CA, USA (14 Nov 1982).

Blanket material selection for fusion reactors is strongly influenced by the desire to minimize safety and environmental concerns. Blanket material safety compatibility studies are being conducted to identify and characterize blanket-coolant-material interactions under postulated reactor accident conditions. Recently completed scoping compatibility tests indicate that : (1) ternary oxides ($LiAlO_2$, Li_2ZrO_3, Li_2SiO_3, Li_4SiO_4 and $LiTiO_3$) at postulated blanket operating temperatures are compatible with water coolant, while liquid lithium and Li_7Pb_2 alloy reactions with water generate heat, aerosol and hydrogen; (2) lithium oxide and $Li_{17}Pb_{83}$ alloy react mildly with water requiring special precautions to control hydrogen release; (3) liquid lithium reacts substantially, while $Li_{17}Pb_{83}$ alloy reacts mildly with concrete to produce hydrogen; and (4) liquid lithium-air reactions present some major safety concerns.

13484 (INIS-mf—7434, pp v) **Plasmafocus.** Deutsch, R. (Innsbruck Univ. (Austria)); Herold, H.; Bertalot, L.; Imam, A.; Jaeger, U.; Kaeppeler, H.J.; Mozer, A.; Oppenlaender, T.; Rueckle, B.; Sauerbrunn, A. 1979. (In German). NTIS (US Sales Only), PC A03/MF A01.

In Research report 1979.

After finishing the experimental hall for the 500 kJ-plasmafocus experiment, the construction of the facility has been started. In the other focus experiments improved methods with high time and spacial resolution have been developed. The results of measurements using these methods show an intimate relation between the neutron yield and the onset of m = 0 instabilities, and give information on the radial electron temperature distribution. (orig./GG).

13485 **(LA-UR—82-3328) Antares facility for inertial-fusion experiments: status and plans.** Goldstone, P.D.; Allen, G.; Jansen, H.; Saxman, A.; Singer, S.; Thuot, M. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 13p. (CONF-821089—5). NTIS, PC A02/MF A01. Order Number DE83003536.

From 6. international workshop on laser interaction and related plasma phenomena; Monterey, CA, USA (25 Oct 1982).

Antares is a large, 30 to 40 kJ CO_2 laser system which will provide a base for experiments to determine the efficiency with which 10 μm light can be used to drive target implosions while maintaining an acceptable level of preheat. Construction of the facility is in the final stages and diagnostics for initial experiments are being designed and constructed with operations scheduled to begin early in FY-84. After an initial shakedown period, we expect to perform a series of measurements to determine the energy scaling of hot electron temperature and target coupling efficiency in selected set of targets including simple spheres. We also expect to contin-

ue experiments, now planned for Helios, to determine whether CO_2-produced ions are appropriate for driving inertial fusion targets with acceptable efficiency (Helios experiments have demonstrated that as much as 40% of the incident light can be converted to fast ions). Details of these experiments, as well as plans for further experiments, are still being defined.

13486 **(MLM—3029) Tritium permeation scoping test.** Kershner, C.J.; Rogers, M.L.; Ellis, R.E. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 20 Dec 1982. Contract AC04-76DP00053. 14p. NTIS, PC A02/MF A01. Order Number DE83003224.

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The efficacy of a permeation experimental design employing dual helium flow loops, flow-through ion chamber detectors and Zr/Al alloy getter pumps was investigated through a series of permeation experiments on as-received 316 stainless steel at 773 K. Tritium partial pressures of 3 to 6 x 10^{-4} Pa (6 to 13 mCi/m^3) were used to simulate the expected first wall background conditions as well as those planned for the EG and G fission reactor studies. The results and observations of the study demonstrated that oxidation of tritium must be prevented if a circulation loop, tritium detection technique is to be successful in an in-reactor assembly. Possible modifications to the in-reactor experimental design are presented.

13487 **(NRL-MR—4947) Stability and symmetry in inertial-confinement fusion.** Emery, M.H.; Bodner, S.E.; Boris, J.P.; Colombant, D.G.; Cooper, A.L.; Fritts, M.J.; Gardner, J.H.; Manheimer, W.H. (Naval Research Lab., Washington, DC (USA)). 9 Dec 1982. Contract AI01-77DP40042. 18p. NTIS, PC A02/MF A01. Order Number DE83005115.

Theoretical progress on several fronts has recently been made through numerical simulations in providing a more complete understanding of the physical processes involved in these asymmetries and instabilities. The results also suggest methods of controlling these processes and their implications for laser fusion systems design. Stability and symmetry issues have been investigated using an adaptively gridded two-dimensional fully nonlinear Eulerian computer model (FAST2D) and a triangular grid Lagrangian computer model (SPLISH). Laser matter coupling and scaling laws relating the asymmetry results to spherical pellet designs have been investigated using a one dimensional sliding zone adaptive gridding fluid code (FAST1D). Principle results include finding (1) the requirements for thermal smoothing of laser nonuniformities, (2) reduced Rayleigh-Taylor growth rates and saturation via the nonlinear Kelvin-Helmholtz roll-up, (3) that perturbation wavelengths greater than the shell thickness are most likely to cause an asymmetric implosion, (4) a new theory based on vortex shedding that explains the reduced linear Rayleigh-Taylor growth rates and (5) a possible wavelength-intensity window for direct illumination where the requirements of pellet velocity, symmetry, and efficiency necessary for high gain can be simultaneously met.

13488 **(NRL-MR—4985) Numerical study of phase conjugation in stimulated Brillouin scattering from an optical waveguide.** Lehmberg, R.H. (Naval Research Lab., Washington, DC (USA)). 30 Dec 1982. Contract AI01-76ET53020. 25p. NTIS, PC A02/MF A01. Order Number DE83005104.

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Phase conjugation in stimulated Brillouin scattering (SBS) from an optical waveguide is studied numerically, using a Cartesian two dimensional propagation code (BOUNCE) that includes pump depletion. The simulations show that light scattered back through a phase aberrator produces a far field profile closely matching that of the incident beam; however, the near field intensity exhibits large and rapid spatial inhomogeneties across the entire aberrator, even for conjugation fidelities H as high as 98%. This effect can be only partially removed by spatial filtering techniques. The dependence of H upon SBS gain, scattering length L, and the average intensity I and angular divergence theta/sub D/ of the pump beam is first studied in the low reflectivity regime (i.e., ignoring pump depletion). For amplitude gains $\geq e^{10}$, H decreases monotonically with the factor I/theta/sub D/ due to a small scale intensity pulling effect. This result appears to be independent of whether theta/sub D/ arises entirely from the aberrator, or from a combination of the aberrator plus curvature introduced by a lens. In all cases, pump depletion is found to enhance the fidelity by inhibiting the small scale pulling effect. Under appropriate conditions, this can actually reverse the intensity dependence of H seen in the absence of pump depletion.

13489 **(ORNL/Sub—79/33200/10) Development program for a 200-kW, c-w gyrotron. Quarterly report No. 10, October-December 1981.** Tancredi, J.J.; Caplan, M.; Sandoval, J.J.; Matranga, V.A. (Hughes Aircraft Co., Torrance, CA (USA). Electron Dynamics Div.). 1981. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01. Order Number DE83004198.

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The objective of this program is the design and development of a millimeter wave device to produce 200 kW of continuous-wave power at 60 GHz. The device, a gyrotron oscillator, will be compatible with power delivery to an electron-cyclotron plasma. Smooth control of rf power output over a 17 dB range is required, and the device should be capable of operation into a severe time-varying load mismatch. During this report period, an analysis of tests on the first gyrotron, S/N 1, was undertaken. In order to understand the mechanism by which a frequency of 3.5 GHz could be emitted from the gun end of the tube, detailed gun tests were performed on S/N 1. These are compared to tests on a previously-built gun tester. In addition a rationalization of the high azimuthal mode content from S/N 1 is also presented. Progress continued on the electrical check-out of a 100 ms pulse modulator.

13490 **(ORNL/TM—7855) ORNL neutral-beam program in 1978.** Whealton, J.H. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 69p. NTIS, PC A04/MF A01. Order Number DE83005173.

This report was presented at the ion source workshop held at Culham Laboratory, Abingdon, Oxfordshire, in 1978. Because the proceedings of that conference are unavailable, and because the material in this report is still not to be found elsewhere, it is issued as a laboratory report. The neutral beam group at Oak Ridge National Laboratory has constructed neutral beam generators for the ORMAK and PLT devices, is presently constructing neutral beam devices for the ISX and PDX devices, and is contemplating the construction of neutral beam systems for the advanced TNS device. These neutral beam devices stem from the pioneering work on ion sources of G.G. Kelley and O.B. Morgan. We describe the ion sources under development at this laboratory, the beam optics exhibited by these sources, as well as some theoretical considerations, and finally the remainder of the beamline design.

13491 **(ORNL/TM—8474) Design concept for the FED poloidal field coils using an internally cooled cable superconductor.** Srivastava, V.C. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 47p. NTIS, PC A03/MF A01. Order Number DE83005153.

A description is given of the conceptual electromagnetic design for the central solenoid and ring coils of the Fusion Engineering Device (FED) employing force-cooled conductors. These coil designs use an internally cooled cable superconductor (ICCS) and appear to be feasible to meet the FED requirements. An innovative manifolding design concept that minimizes the space requirement is proposed. The force-cooled ohmic heating (OH) solenoid is designed to operate at 8 T. These coils do not require leak-tight helium vessels, which are difficult to design. The overall current density (including the structural support) is higher for the concept employing ICCS conductor than for the reference concept employing the pool-boiling conductor.

13492 **(ORNL/TM—8504) Streaming of 14-MeV neutrons through an iron duct: comparison of measured neutron and gamma-ray energy spectra with results calculated using the Monte Carlo code MCNP.** Santoro, R.T.; Barnes, J.M.; Soran, P.D.; Alsmiller, R.G. Jr. (Oak Ridge National Lab., TN (USA)). Nov 1982. Contract W-7405-ENG-26. 29p. NTIS, PC A03/MF A01. Order Number DE83003349.

Neutron and gamma-ray energy spectra resulting from the streaming of 14 MeV neutrons through a 0.30-m-diameter duct

(length-to-diameter ratio = 2.83) have been calculated using the Monte Carlo code MCNP. The calculated spectra are compared with measured data and data calculated previously using a combination of discrete ordinates and Monte Carlo methods. Comparisons are made at twelve detector locations on and off the duct axis for neutrons with energies above 850 keV and for gamma rays with energies above 750 keV. The neutron spectra calculated using MCNP agree with the measured data within ~ 5 to ~ 50%, depending on detector location and neutron energy. Agreement with the measured gamma-ray spectra is also within ~ 5 to ~ 50%. The spectra obtained with MCNP are also in favorable agreement with the previously calculated data and were obtained with less calculational effort.

13493 **(ORNL/TM—8515) Ultrasonic examination of JBK-75 strip material.** Cook, K.V.; Cunningham, R.A. Jr.; Lewis, J.C.; McClung, R.W. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 30p. NTIS, PC A03/MF A01. Order Number DE83004688.

An ultrasonic inspection system was assembled to inspect the JBK-75 stainless steel sheath material (for the Large Coil Project) for the Westinghouse-Airco superconducting magnet program. The mechanical system provided for handling the 180-kg (400-lb) coils of strip material [1.6 mm thick by 78 mm wide by 90 to 120 m long (0.064 by 3.07 in. by 300 to 400 ft)], feeding the strip through the ultrasonic inspection and cleaning stations, and respooling the coils. We inspected 54 coils of strip for both longitudinal and laminar flaws. Simulated flaws were used to calibrate both inspections. Saw-cut notches [0.28 mm deep (0.011 in., about 17% of the strip thickness)] were used to calibrate the longitudinal flaw inspections; 1.59-mm-diam (0.063-in.) flat-bottom holes drilled halfway through a calibration strip were used to calibrate the laminar flaw tests.

13494 **(ORNL/TM—8593) Physical sputtering of candidate plasma-side materials for FED/INTOR.** Roberto, J.B. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 35p. NTIS, PC A03/MF A01. Order Number DE83005171.

Physical sputtering data are reviewed for a variety of candidate plasma-side materials for fusion reactor applications. Normal incidence sputtering yields are presented for both light and heavy ions (including H, D ^{4}He, and self-ions) on Be, B, C, SiC, TiC, V, stainless steel, Mo and W targets for energies ranging from the sputtering threshold up to 10 keV and higher. The available data are compared with model calculations for H, D, T, ^{4}He, and self-ion sputtering of the candidate materials. The influence of angle of incidence, surface composition and morphology, and target temperature is discussed. The sputtering of multi-component targets and the energy and angular distributions of sputtered atoms are also considered. It is found that the existing data and models are adequate for factor-of-two estimates of physical sputtering yields for most of the relevant energies and ion-target combinations.

13495 **(PPPL—1960) Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium.** Buxbaum, R.E.; Johnson, E.F. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1982. Contract AC02-76CH03073. 16p. NTIS, PC A02/MF A01. Order Number DE83005050.

The separation of tritium from liquid lithium at low concentrations is an important problem for fusion technology. One of the most promising techniques for effecting this separation involves sorbing the tritium on solid yttrium metal. Reliable diffusivity data are essential for a realistic evaluation of this technique. This paper reviews the bodies of relevant experimental diffusivity data, i.e., data on protium diffusion in liquid lithium, protium diffusion in solid yttrium, and the isotope effect in metals.

13496 **(UCRL—15367-Pt.3) Research on the HYLIFE liquid-first-wall concept for future laser-fusion reactors: liquid jet impact experiments. Final report No. 8.** Hoffman, M.A. (California Univ., Davis (USA). Dept. of Mechanical Engineering). Aug 1982. Contract W-7405-ENG-48. 41p. NTIS, PC A03/MF A01. Order Number DE83004209.

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The goal of this initial scoping study was to evaluate the transient and steady state drag of a single bar and of some selected arrays of bars and to determine the momentum removed from impacting liquid slugs. In order to achieve this aim, use has been made of both the published literature and experimental data obtained from a small-scale experimental apparatus. The implications of two possible scaling laws for use in designing the small-scale experiment are discussed. The use of near-universal curves to evaluate the momentum removed during the initial transient period is described. The small-scale apparatus used to obtain steady-state drag data is described. Finally, these results are applied to the HYLIFE fusion reactor.

13497 **(UCRL—87122) Resonantly-pumped soft-x-ray lasers using ICF drivers.** Hagelstein, P.L. (Lawrence Livermore National Lab., CA (USA)). Dec 1982. Contract W-7405-ENG-48. 9p. (CONF-821089—6). NTIS, PC A02/MF A01. Order Number DE83004305.

From 6. international workshop on laser interaction and related plasma phenomena; Monterey, CA, USA (25 Oct 1982).

Some aspects of laser design relating to experiments planned for the NOVETTE laser system at Livermore in early 1983 are discussed. The experiments are aimed at testing several resonantly-pumped lasers with transition energies between 42.3 eV and 153 eV. These experiments follow several years of theoretical work, a set of flashlamp characterization experiments performed on the SHIVA laser system (LLNL) in December, 1981, and some high precision spectroscopic studies carried out at KMS during the summer of 1982. Some of the major physics design issues as the relate to the experiments, and some of the numerical simulations that have been carried out so far are reviewed.

13498 **(UCRL—87735-Rev.1) Changing MFTF vacuum environment.** Margolies, D.; Valby, L. (Lawrence Livermore National Lab., CA (USA)). Dec 1982. Contract W-7405-ENG-48. 24p. (CONF-821111—2-Rev.1). NTIS, PC A02/MF A01. Order Number DE83004285.

From 29. national symposium on American Vacuum Society; Baltimore, MD, USA (16 Nov 1982).

The Mirror Fusion Test Facility (MFTF) vacuum vessel will be about 60m long and 10m in diameter at the widest point. The allowable operating densities range from 2×10^9 to 5×10^{10} particles per cc. The maximum leak rate of 10^{-6} tl/sec is dominated during operation by the deliberately injected cold gas of 250 tl/sec. This gas is pumped by over 1000 square meters of cryopanels, external sorption pumps and getters. The design and requirements have changed radically over the past several years, and they are still not in final form. The vacuum system design has also changed, but more slowly and less radically. This paper discusses the engineering effort necessary to meet these stringent and changing requirements. Much of the analysis of the internal systems has been carried out using a 3-D Monte Carlo computer code, which can estimate time dependent operational pressures. This code and its use will also be described.

13499 **(Y/DX—103) Laser-interferometer position-feedback for precision machine tools.** Barkman, W.E. (Oak Ridge Y-12 Plant, TN (USA)). 15 Apr 1980. Contract W-7405-ENG-26. 6p. (CONF-800805—4). NTIS, PC A02/MF A01. Order Number DE83005509.

From Joint automatic control conference; San Francisco, CA, USA (13 Aug 1980).

Diamond turning of off-axis parabolic mirrors is used to provide high-quality turning and focusing optics for the Los Alamos Scientific Laboratory's laser-fusion research. These mirrors are fabricated at the Oak Ridge Y-12 Plant on a large machine tool that incorporates lasers, air bearings, and linear-motor slide-drives to meet the part specifications of 0.63 μm (25 μin) on contour and 63 nm (2.5 μin) on surface finish. This report discusses the application of lasers to this machine and other precision machine tools.

13500 **(SAND—82-1398-Vol.6-No.1) Sandia technology.** (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01. Order Number DE83004127.

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A review of Sandias' inertial fusion program is given. The PBFA is described. (MOW)

13501 **Density rise experiment on PLT.** Strachan, J.D.; Bretz, N.; Mazzucato, E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* 22: No. 9, 1145-1159(Sep 1982).

The evolution of the density profile in PLT during intense gas puffing is documented and analysed. Measurements of the spectrum of low-energy edge neutrals and of the change in central neutral density indicate that charge-exchange processes alone cannot account for the central density rise. The transient density profile changes can be reproduced numerically by a diffusivity of approximately $10^4 cm^2.s^{-1}$ and a spatially averaged inward flow of $10^3 cm.s^{-1}$. These transport coefficients are 10-10^2 times larger than neoclassical. The ion energy confinement is reduced, the small-scale density fluctuations are increased, and runaway electron losses are increased during the density rise.

13502 **Particle beams generated by a 6-12.5 kJ dense plasma focus.** Stygar, W.; Gerdin, G.; Venneri, F.; Mandrekas, J. (Fusion Studies Lab., 214 Nuclear Engineering Lab., Urbana, IL, USA). *Nuclear Fusion;* 22: No. 9, 1161-1172(Sep 1982).

Particle beam diagnostic tools involving an ion beam Faraday cup, an electron beam Faraday cup, an electron magnetic spectrometer and solid-state nuclear track detectors have been used to measure the parameters of the particle beams generated by a Mather-type dense plasma focus. At a capacitor bank energy of 12.5 kJ, the energy spectra of the electron and ion beams are found to obey the same power laws: dN/dE proportional to Esup(-x) where x approximately equal to 3.5+-0.5. Primary electron beam current and energy spectra were measured as a function of main bank current at pinch time, Isub(MB). The primary electron beam current was found to scale as Isub(MB)sup(2.9+-0.5), reaching a magnitude of 17 kA for a device energy of 12.5 kJ. The exponent x of the electron energy spectra was found to scale as x proportional to Isub(MB)sup(-1.15+-0.2). These results are incorporated into an axial beam target model for neutron production, and it is found that this model could account for the magnitude and scaling of the observed neutron yield with Isub(MB).

13503 **Superconducting magnets for fusion.** Haubenreich, P.N.; Lubell, M.S. (Oak Ridge National Lab., TN (USA)); Cornish, D.N. (Lawrence Livermore National Lab., CA (USA)); Beard, D.S. (Department of Energy, Washington, DC (USA). Office of Fusion Energy). *Nuclear Fusion;* 22: No. 9, 1209-1236(Sep 1982).

With the intention of informing the broad community of fusion researchers, the background, status, and potential future uses of superconducting magnets are covered. After a brief explanation of the principles of superconducting magnets, the technological basis is examined. Major emphasis is on the description of activities in the worldwide development and application of superconducting magnets in fusion programmes through mid-1981. Evaluation of progress and projection of needs for fusion reactors lead to the conclusion that superconducting magnets can be available when required.

13504 **Supersonic gas target for a bundle divertor plasma.** Chang, F.R. (National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center); Fisher, J.L. (The Charles Stark Draper Lab., Inc., Cambridge, MA, USA). *Nuclear Fusion;* 22: No. 8, 1003-1013(Aug 1982).

A novel gas target concept for recovering both energy and particles from a high-energy plasma stream is presented. This concept includes the maintenance of a pressure discontinuity by a normal shock and a very high mass flow rate in a relatively small system. The pressure discontinuity allows the exhaust plasma stream to minimize backflow into the plasma, by interacting with the target in a low-pressure region; the high mass flow rate allows exit temperatures that are reasonable from a materials viewpoint and suitable for energy recovery.

13505 **Efficient technique for magnetic analysis of non-circular, high-beta tokamak equilibria.** Swain, D.W.; Neilson, G.H. (Oak Ridge National Lab., TN (USA)). *Nuclear Fusion;* 22: No. 8, 1015-1030(Aug 1982).

A method for determining plasma shape and global properties of high-beta non-circular tokamak equilibria (βsub(p), β, q and lsub(i)) from magnetic sensor data is described. The technique uses a least-squares fitting procedure to find the plasma boundary and a global force balance analysis (as opposed to a complete solution of the MHD equilibrium equation) to determine plasma pressure. Estimates of the uncertainties in the computed quantities are also obtained, and the method is fast enough that it can be used to provide a complete time history (up to 100 time points) of ISX-B high-beta discharges within two to three minutes of each shot. Values obtained using this method are in excellent agreement with more detailed measurements and with free-boundary MHD equilibrium computations.

13506 **Dynamic behaviour of intrinsic impurities in Doublet III discharges.** Jahns, G.L.; Ejima, S.; Groebner, R.J. (General Atomic Co., San Diego, CA (USA)). *Nuclear Fusion;* 22: No. 8, 1049-1059(Aug 1982).

Before a complete set of impurity control techniques were implemented in the Doublet III tokamak, two distinct discharge types were obtained, with nearly equal probability at high power densities with the same external control parameters. In the normal discharge (type S), sawtooth activity develops quickly and no impurity peaking on axis occurs thereafter. The other type of discharge (type O) initiates with more plasma/wall interaction, proceeds through the current-ramp phase with no central MHD activity, and impurity density profiles are found to be peaked on axis. Later in the current flat-top phase, type-O discharges experience the sudden onset of a large oscillation with m=1, n=1, and a concurrent decrease of central impurity densities. The (sinusoidal) oscillation eventually evolves into sawteeth, and type-O discharges attain a final state identical to type-S discharges. Measurements of absolute impurity densities show a direct correlation of impurity confinement with the presence or absence of tearing-mode activity, which suggests that the impurity transport is modified by the influence of the m=1 magnetic island.

13507 **Neoclassical ripple transport in tokamaks.** Shaing, K.C.; Callen, J.D. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). *Nuclear Fusion;* 22: No. 8, 1061-1068(Aug 1982).

The usual ripple transport calculations lead to a nu^{-1} scaling of the transport coefficients with collision frequency nu. The paper extends and clarifies this scaling by taking into account the fact that the dominant contributions to transport come from particles in the high-energy tail of the distribution function. This means that particles with energy E approximately (4-6)T dominate, and this restricts the nu^{-1} scaling range to nu(T)>(E/T)sup(5/2)deltaωsub(d)(T) approximately 100 delta ω sub(d)(T), where T is the thermal energy, delta is the ripple-well depth, and $\omega sub(d)^{-1}$ is the time to drift over the region where the localized ripple well exists. In addition, transport coefficients are derived in weak-ripple (α is identical to epsilon/Nqdelta>>1, with epsilon the inverse aspect ratio, N the number of toroidal coils, q the safety factor), low-collisionality regimes where the radial step size is determined by the distance a particle drifts before it 'collisionlessly detraps' from a ripple well. The maximum transport rate is found to be about two orders of magnitude smaller than usually assumed, primarily because of the restriction of the nu^{-1} scaling regime to the much higher collision frequencies.

13508 **Influence of diamagnetic drifts on critical beta in tokamaks.** Tang, W.M.; Dewar, R.L.; Manickam, J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* 22: No. 8, 1079-1081(Aug 1982).

In specific cases, the critical beta (βsub(c)) for stability against internal magnetohydrodynamic (MHD) ballooning modes can be improved significantly by taking into account the stabilizing influence of the ion diamagnetic drifts. This kinetic modification to the ideal MHD analysis and radial corrections to the local theory are included in a calculation of βsub(c) as a function of toroidal

mode number (n) for a particular tokamak equilibrium sequence of interest.

13509 **Sawtooth oscillations in the flux of runaway electrons to the PLT limiter.** Barnes, C.W.; Strachan, J.D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* **22**: No. 8, 1090-1094(Aug 1982).

Increased fluxes of runaway electrons at the PLT limiter are observed in the few milliseconds following internal disruptions. These fluxes have an inverted (outside) sawtooth character. The time for the flux to reach a maximum after the disruptions has been studied as a function of the plasma parameters for thousands of PLT discharges. One interpretation is that this delay represents the time for a perturbation to the runaway electron population to travel from the q=1 region to the plasma boundary. These times are approximately 10^{-1} of the electron thermal confinement times and increase with the plasma electron density.

13510 **Feedback stabilization of rigid axisymmetric modes in tokamaks.** Jardin, S.C.; Larrabee, D.A. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* **22**: No. 8, 1095-1098(Aug 1982).

Non-circular tokamak plasmas can be unstable to ideal-MHD axisymmetric instabilities. Passive conductors with finite resistivity will at best slow down these instabilities to the resistive (L/R) time of the conductors. It is demonstrated that a simple active feedback system far from the plasma which responds on this resistive time can stabilize the system, provided its mutual inductance with the passive coils is small enough.

13511 **Systematic investigtion of material activation on the TFTR.** Ku, L.; Kolibal, J.G. (Princeton University, Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ 08544). *Transactions of the American Nuclear Society;* **41**: 167(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13512 **EBT-P gamma-ray shielding analysis.** Gohar, Y. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **41**: 517-518(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13513 **Tritium-tritium fusion: blanket neutronics and photonics.** Ragheb, M.M.H.; Smith, J. (University of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **41**: 508-510(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13514 **Generation of DT and DD neutrons from high-power neutral-beam dumps.** Perkins, L.J. (University of Wisconsin, Madison, WI 53706). *Transactions of the American Nuclear Society;* **41**: 507-508(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13515 **Analysis of dd fusion neutron transport in thick concrete.** Ku, L.P. (Princeton University, Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ 08544). *Transactions of the American Nuclear Society;* **41**: 506-507(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13516 **Thermal-hydraulics design considerations for the STARFIRE-DEMO breeding blanket.** Misra, B.; Clemmer, R.G.; Smith, D.L. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **41**: 169(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13517 **Tritium control for the DEMO liquid-metal blanket design.** Finn, P.A. (Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439). *Transactions of the American Nuclear Society;* **41**: 171(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13518 **Maximum tritium production in toroidal fusion reactors with no inboad breeding.** Micklich, B.J.; Clifford, C.E.; Jassby, D.L. (Princeton University, Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ 08544). *Transactions of the American Nuclear Society;* **41**: 172(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13519 **A high-temperature fusion blanket for synfuel and electrical production.** Garner, J.K.; Berwald, D.H.; Gerald, J.D.; Whitley, R.H. (TRW, One Space Park, Redondo Beach, CA 90278). *Transactions of the American Nuclear Society;* **41**: 173(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13520 **Cross-section sensitivity analysis for a tandem mirror hybrid reactor and considerations regarding new ^{9}Be (n, 2n) cross-section evaluations.** Youssef, M.Z.; Berwald, D.H.; Whitley, R.H. (University of California at Los Angeles, Los Angeles, CA 90024). *Transactions of the American Nuclear Society;* **41**: 175(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13521 **A care inventory model for fuel trajectory analysis in fusion-fission symbiotic systems.** Kunimoto, Y.; Davidson, J.W.; Hertel, N.E. (University of Texas, Austin, TX 78712). *Transactions of the American Nuclear Society;* **41**: 178(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13522 **An FRTP fusion ignition experiment.** Miley, G.H.; Fang, Q.T.; Gilligan, J.G. (University of Illinois, Urbana, IL 61801). *Transactions of the American Nuclear Society;* **41**: 168(Jun 1982). (CONF-820609—).

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

13523 **Neutral beam effects on tokamak ballooning mode stability.** Cooper, W.A. (Oak Ridge National Lab., TN (USA); Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering); Bateman, G. (Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering); Nelson, D.B. (Department of Energy, Washington, DC (USA). Office of Fusion Energy); Kammash, T. (Michigan Univ., Ann Arbor (USA). Dept. of Nuclear Engineering). *Plasma Physics;* **23**: No. 2, 105-120(Feb 1981).

An equation is derived that gives a necessary, as well as sufficient, stability criterion for the guiding center plasma to instabilities of large toroidal mode number. It is found that quasi-perpendicular injection induces a displacement of the psub(perpendicular to) contours with respect to the flux surfaces away from the destabilizing curvature region, which enhances the stability of tensor pressure equilibria over comparable scalar pressure equilibria. Also found is a distinct difference between the necessary and sufficient stability limits when the most unstable modes concentrate in regions of relatively high pressure. Both stability criteria coalesce when ballooning modes, which appear near the edge of the plasma where the pressure is low, dominate.

13524 **Studies of laser-plasma interactions, emphasizing ablative acceleration of thin foils.** Stamper, J.A.; Bodner, S.E.; Colombant, D.G.; Decoste, R.; Gold, S.H.; Grun, J.; Lehmberg, R.H.; Manheimer, W.M. (Naval Research Lab., Washington, DC). pp 617-650 of Laser interaction and related plasma phenomena. Schwarz, H.J.; Hora, H.; Lubin, M.J.; Yaakobi, B. New York, NY; Plenum (1981).

From 5. workshop on laser interaction; Rochester, NY, USA (5 Nov 1979).

Introduction is given which discusses the irradiance constraints and some simple theoretical models. These simple models serve to introduce certain concepts and quantities needed to understand the experimental results. The NRL Pharos II Nd-glass laser system is outlined and a variety of diagnositcs are described including: incident and scattered laser light; particle energy, momentum and velocity; x-ray imaging and spectra; visible spectroscopy; and laser probing, including Doppler studies, inter-ferometry and dual-time shadowgraphy. Studies with these diagnostics are discussed and experimental results presented. Finally, a brief discussion is given of recent theoretical topics: optical ray retracing in stimulated backscatter and absorption and thermal flux inhibition due to ion acoustic turbulence.

13525 **Electron transport effects in laser produced plasmas.** Mason, R.J. (Los Alamos Scientific Laboratory, Los Alamos, NM). pp 743-754 of Laser interaction and related plasma phenomena. Schwarz, H.J.; Hora, H.; Lubin, M.J.; Yaakobi, B. New York, NY; Plenum (1981).

From 5. workshop on laser interaction; Rochester, NY, USA (5 Nov 1979).

A Monte Carlo hybrid scheme for the study of transport inhibition is outlined. It use indicates that return-current thermal convection thru density troughs may be a significant inhibition mechanism. Inhibition by thermal electron trapping is also suggested.

13526 **Nonlinear rehavior of stimulated scatter in large underdense plasmas.** Kruer, W.L.; Estabrook, K.G. (University of California, Lawrence Livermore Lab., Livermore, CA). pp 783-800 of Laser interaction and related plasma phenomena. Schwarz, H.J.; Hora, H.; Lubin, M.J.; Yaakobi, B. New York, NY; Plenum (1981).

From 5. workshop on laser interaction; Rochester, NY, USA (5 Nov 1979).

Several nonlinear effects which limit Brillouin and Raman scatter of intense light in large underdense plasmas are examined. After briefly considering ion trapping and harmonic generation, we focus on the self-constraint ion heating which occurs as an integral part of the Brillouin scattering process. In the long-term nonlinear state, the ion wave amplitude is determined by damping on the heated ion tail which self-consistently forms. A simple model of the scatter is presented and compared with particle simulations. A similar model is also applied to Raman scatter and compared with simulations. Our calculations emphasize that modest tails on the electron distribtuion function can significantly limit instabilities involving electron plasma waves.

13527 **Spectroscopic density measurements in compressed plasmas.** Griem, H.R. (University of Maryland, College Park, MD). pp 811-818 of Laser interaction and related plasma phenomena. Schwarz, H.J.; Hora, H.; Lubin, M.J.; Yaakobi, B. New York, NY; Plenum (1981).

From 5. workshop on laser interaction; Rochester, NY, USA (5 Nov 1979).

X-ray line spectra from compressed DT plasmas seeded with, e.g., neon or argon have been used in several laboratories to determine densities and, to some extent, also diameters near maximum compression. Most useful are the various hydrogen and helium-like satellites, respectively. Densities can be inferred both from the widths of lines and from the relative intensities of some satellites, provided the capacity is not too large. Diameters then follow from the widths of lines having large opacities. The theoretical foundations and limits of the various methods are discussed.

13528 **Compression measurement in laser driven implosion experiments.** Attwood, D.T.; Cambell, E.M.; Ceglio, N.M.; Lane, S.L.; Larsen, J.T.; Matthews, D.M. (University of California, Lawrence Livermore Lab., Livermore, CA). pp 423-462 of Laser interaction and related plasma phenomena. Schwarz, H.J.; Hora, H.; Lubin, M.J.; Yaakobi, B. New York, NY; Plenum (1981).

From 5. workshop on laser interaction; Rochester, NY, USA (5 Nov 1979).

This paper discusses the measurement of compression in the context of the Inertial Confinement Fusion Programs' transition from thin-walled exploding pusher targets, to thicker walled targets which are designed to lead the way towards ablative type implosions which will result in higher fuel density and pR at burn time. These experiments promote desirable reactor conditions but pose diagnostic problems because of reduced multi-kilovolt x-ray and reaction product emissions, as well as increasingly more difficult transport problems for these emissions as they pass through the thicker pR pusher conditions. Solutions to these problems, pointing the way toward higher energy twodimensional x-ray images, new reaction product imaging ideas and the use of seed gases for both x-ray spectroscopic and nuclear activation techniques are identified.

13529 **Replacement of large torus shield sectors in ETF with remote techniques.** Fuller, G.M. (ETF, ORNL, Oak Ridge, TN 37830). *Transactions of the American Nuclear Society;* **35**: 601(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

13530 **Tandem mirror next step-remote maintenance.** Doggett, J.N.; Damm, C.C.; Hanson, C.L. (LLNL, Livermore, CA 94550). *Transactions of the American Nuclear Society;* **35**: 603-604(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

13531 **Remote systems requirements for tandem-mirror fusion power reactors.** Zahn, H.S.; Curtis, C.T. (McDonnell Douglas Astro, St. Louis, MO 63166). *Transactions of the American Nuclear Society;* **35**: 604-605(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

13532 **Remote handling features of the fusion materials irradiation test (FMIT) facility.** Klos, D.B.; Kelly, V.P.; Wierman, R.W.; Yount, J.A. (Westinghouse Hanford, Richland, WA 99352). *Transactions of the American Nuclear Society;* **35**: 605-607(1980). (CONF-801107—).

From ANS international conference; Washington, DC, USA (17 Nov 1980).

99 GENERAL AND MISCELLANEOUS

13533 **(NP—3900369) Argentine National Atomic Energy Commission annual report, 1980.** (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1982. 47p. (In Spanish). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900369.

Portions of document are illegible.

Information is presented on the activity and location of nuclear research centers, uranium production and exploration, radioisotope and radiation studies, research and development, nuclear safety, and radiation protection, personnel and organization. 3 tables.

9901 Management

13534 (DOE/MA—0090) Types of Contracts and Agreements Guide (Part II): cost-plus-award-fee contracting. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Directorate of Procurement and Assistance Management). Apr 1978. 90p. NTIS, PC A05/MF A01. Order Number DE83004396.

Portions of document are illegible.

The Department of Energy publication titled Types of Contracts and Agreements Guide consists of two parts: Part I - types of contracts and agreements; and Part II - cost-plus-award-fee contracting. Each part of the Guide serves a purpose: Part I provides a comprehensive introduction to a wide variety of contract types and agreements; Part II provides a detailed examination and explanation of fundamentals, tools and techniques for successful cost-plus-award-fee (CPAF) contracting. In both format and content, this Part II is designed to be of service and assistance to those persons assigned responsibilities for the development, preparation, negotiation, award and administration of CPAF contracts. Its scope includes activities and actions across the entire acquisition process, from early program and procurement planning through the day-to-day functions of technical evaluation and assessment under a contract.

13535 (LBL—13840) Materials and Molecular Research Division. Annual report 1981. (Lawrence Berkeley Lab., CA (USA)). Aug 1982. Contract AC03-76SF00098. 344p. NTIS, PC A15/MF A01. Order Number DE83004059.

Portions of document are illegible. Printed copy available until stock is exhausted.

Progress is reported in the areas of materials sciences, chemical sciences, nuclear sciences, fossil energy, advanced (laser) isotope separation technology, energy storage, superconducting magnets, and nuclear waste management. Work for others included phase equilibria for coal gasification products and β-alumina electrolytes for storage batteries. (DLC)

13536 (UCRL—88465) Experimental design and data analysis. Grotch, S.L. (Lawrence Livermore National Lab., CA (USA)). 7 Dec 1982. Contract W-7405-ENG-48. 36p. (CONF-821038—7). NTIS, PC A03/MF A01. Order Number DE83004143.

From 10. annual DOE compatibility conference; Albuquerque, NM, USA (26 Oct 1982).

Portions of document are illegible.

This paper focuses on a number of the considerations found to be of practical importance in the areas of experimental design and data analysis. These are discussed using a format in which these issues are first raised in terms of questions and then explored in general terms. A real practical example of model building, using actual cushion data, is given. This discussion shows some of the pitfalls which can be encountered when using empirical models. The use of confidence limits in assessing the predictive ability of models is also explored. Finally, some suggestions are given to aid the novice in experimental design.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 11852, 11926, 12301, 12337, 12340, 12346, 13008, 13379

13537 (ANL—82-73) Randomly generated test problems for positive definite quadratic programming. Lenard, M.L.; Minkoff, M. (Argonne National Lab., IL (USA)). Oct 1982. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01. Order Number DE83004400.

A procedure is described for randomly generating positive definite quadratic programming test problems. The test problems are constructed in the form of linear least squares problems subject to linear constraints. The probability measure for the problems so generated is invariant under orthogonal transformations. The procedure allows the user to specify the size of the least squares problem (number of unknown parameters, number of observations, and number of constraints); the relative magnitude of the residuals; the condition number of the Hessian matrix of the objective function; and the structure of the feasible region (number of equality constraints and the number of inequalities which will be active at the feasible starting point and at the optimal solution). An example is given illustrating how these problems can be used to evaluate the performance of a software package.

13538 (BDX—613-2886) Bendix CAD-CAM site plan. Smith, M.L. (Bendix Corp., Kansas City, MO (USA)). Dec 1982. Contract AC04-76DP00613. 45p. NTIS, PC A03/MF A01; 1. Order Number DE83005327.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

The Bendix Site Plan for CAD-CAM encompasses the development and integration of interactive graphics systems, factory data management systems, robotics, direct numerical control, automated inspection, factory automation, and shared data bases to achieve significant plant-wide gains in productivity. This plan does not address all current or planned computerization projects within our facility. A summary of planning proposals and rationale is presented in the following paragraphs. Interactive Graphics System (IGS) capability presently consists of two Applicon CAD systems and the CD-2000 software program processing on a time-shared CYBER 174 computer and a dedicated CYBER 173. Proposed plans include phased procurment through FY85 of additional computers and sufficient graphics terminals to support projected needs in drafting, tool/gage design, N/C programming, and process engineering. Planned procurement of additional computer equipment in FY86 and FY87 will provide the capacity necessary for a comprehensive graphics data base management system, computer-aided process planning graphics, and special graphics requirements in facilities and test equipment design. The overall IGS plan, designated BICAM (Bendix Integrated Computer Aided Manufacturing), will provide the capability and capacity to integrate manufacturing activities through a shared product data base and standardized data exchange format. Planned efforts in robotics will result in productive applications of low to medium technology robots beginning in FY82, and extending by FY85 to work cell capabilities utilizing higher technology robots with sensors such as vision and instrumented remote compliance devices. A number of robots are projected to be in service by 1990.

13539 (BNL—51432-Rev.A) Introduction to the Central Scientific Computing Facilities. Fuchel, K. (ed.). (Brookhaven National Lab., Upton, NY (USA)). Jun 1982. Contract AC02-76CH00016. 62p. NTIS, PC A04/MF A01. Order Number DE83002247.

Introduction to the CSCF is the first of several documents which make up the BNL CSCF Computer Users Guide. The Introduction provides a broad picture of hardware and software facilities and operational policies of the CSCF. Adhering to the premise that CDC and other software purveyors provide sufficient documentation for their products, the Introduction does not reproduce material found elsewhere but refers the reader to the sections of the manuals pertinent to a particular area of interest.

13540 (CEA-N—2262) Elements of methodology for study the failures of great systems. Logical and algebraic calculus. Vergez, Pierre. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1982. 70p. (In French). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703389.

The methodology described here talks about some parts of the study concerning the failures of a determined system or supposed such. In these parts appears the most important logical and algebraic calculus. They are processed after the transformation of the system in the form of an equivalent functional scheme. The purpose of this methodology is the study of the effect of failure, of repairing or drift for one or several devices.

13541 (CEA-N—2268) Numerical solution of large sparse linear systems. Meurant, G.; Golub, G. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Feb 1982. 278p. (In French). NTIS (US Sales Only), PC A13/MF A01. Order Number DE82703391.

This note is based on one of the lectures given at the 1980 CEA-EDF-INRIA Numerical Analysis Summer School whose aim is the study of large sparse linear systems. The main topics are solv-

ing least squares problems by orthogonal transformation, fast Poisson solvers and solution of sparse linear system by iterative methods with a special emphasis on preconditioned conjuguate gradient method.

13542 **(CEA-N—2275) Tools for developing software for different types of microprocessors, to be used, in particular, for the acquisition and processing of nuclear data.** Maloeuvre, Michel. (Paris-11 Univ., 91 - Orsay (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1982. 248p. (In French). NTIS (US Sales Only), PC A11/MF A01. Order Number DE82703063.

It is difficult to imagine the realization of a system with a microprocessor without the use of an adapted development system. As these systems are prohibitively expensive, it is difficult for a laboratory to acquire them. A computer, such as the Multi 20 is provided with programme generating tools and supervisors to put the computer's resources at the microprocessor's disposal. An electronic crate assures interface functions with the computer, the emulation of the microprocessor and the loading of EROM and the live memory bank in order to execute the different units integrated into the crate, enables the crate to be used as a portable repair and maintenance outfit for the materials installed. In the first part of the text, we present the principles of the development tools showing how they are used to realize microprocessor equipment. In the second part, the software is optimized together with the choice of materials in order to define a low cost development system.

13543 **(CERN—82-07) Erigone bus study.** Durieu, L.; Vignes, M.; Wolstenholme, P. (European Organization for Nuclear Research, Geneva (Switzerland)). 16 Jun 1982. 34p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703376.

A study has been made of some factors determining the performance and cost-effectiveness of microcomputer bus systems implemented in Europa crates. An experimental system has been specified and a number of modules constructed in accordance with the specification, in order to test the validity of some of the ideas proposed. It has been demonstrated that the bus interfacing logic can be simple and inexpensive, while maintaining a high degree of processor independence and also a high degree of transparency in operation. The number of pins required by the bus is minimized by multiplexing address and data. A series termination for the drive of the multiplexed lines permits cross-talk to be reduced to insignificant levels: this technique is recommended for wider application. The experimental bus is proposed as a basis for the construction of simple microcomputer-based instrumentation systems.

13544 **(DOE/ER/03443—T1) Report on progress and results obtained under contract No. AS05-76-ER03443 until October 31, 1980.** Babuska, I. (Maryland Univ., College Park (USA)). 1980. Contract AS05-76ER03443. 6p. NTIS, PC A02/MF A01. Order Number DE83003089.

Research effort concentrated in the following two areas: (1) the finite element method: the a-propri and a-posteriori error bounds, adaptive approaches, etc. and (2) the problem of the mixed type: basic properties of solutions of the differential equations which are elliptic in one part of the domain and hyperbolic in the other, the numerical treatment of such problems.

13545 **(DOE/TIC—3386) Computer codes: a bibliography.** Cunningham, D.C. (ed.). (Department of Energy, Oak Ridge, TN (USA). Technical Information Center). May 1981. 924p. NTIS, PC A99/MF A01. Order Number DE83006019.

Included are 3916 citations to literature on computer codes contained in the DOE Energy Data Base for the period 1974 through March 1981. The citaticns represent all Energy Data Base subject categories and include reports, journal articles, books, conference papers, and monographs. Corporate, Personal Author, Subject, and Report Number Indexes are provided.

13546 **(DOE/TIC—3386) Computer codes: a bibliography.** Cunningham, D.C. (ed.). (Department of Energy, Oak Ridge, TN (USA). Technical Information Center). May 1981. 924p. NTIS, PC A99/MF A01. Order Number DE83006019.

Included are 3916 citations to literature on computer codes contained in the DOE Energy Data Base for the period 1974 through March 1981. The citations represent all Energy Data Base subject categories and include reports, journal articles, books, conference papers, and monographs. Corporate, Personal Author, Subject, and Report Number Indexes are provided.

13547 **(DP-MS—82-48) Savannah River Laboratory local area computer network.** Johnson, A.J. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1982. Contract AC09-76SR00001. 11p. (CONF-821157—1). NTIS, PC A02/MF A01. Order Number DE83004918.

From DOE mini/microcomputer information interchange conference; Los Alamos, NM, USA (3 Nov 1982).

The Savannah River Laboratory (SRL) has been using minicomputers and microcomputers for nearly twenty years to support the research and development needs of the site. There are currently in use at SRL over sixty of these systems providing experimental data acquisition, runtime control, runtime and postrun analysis, data archiving, and reporting services for individual experiments. More recently, many personal computers have been acquired for desk top computing by SRL's professionals. The various laboratory and personal computers range in size from the 32-bit super minicomputers to dedicated, 8-bit single-board computers. A local area network (LAN) has been defined to support this environment. The major components of the LAN are defined to be the data acquisition and personal computers, larger computer systems for data analysis and peripheral support, and a high-speed, baseband local communications bus. A pilot scale LAN has been implemented using the ETHERNET (Xerox Corporation, Digital Equipment Corporation, Intel Corporation) baseband network. This pilot network is being used to provide data transfers between the laboratory minicomputers and microcomputers to the site central computer facility via a minicomputer serving as a Remote Job Entry (RJE) station. Devices are connected to the ETHERNET via standard parallel and serial interfaces. A major expansion to the network is scheduled for 1983 with the addition of data analysis computers. These computers will provide for a more interactive data analysis capability and will fill an intermediate position in a hierarchy of computer resources.

13548 **(ECN—117) COMFIT. A computer program for determining best fitting curves.** Zijp, W.L.; Aaldijk, J.K. (Stichting Energieonderzoek Centrum Nederland, Petten). May 1982. 70p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703064.

6 figs., 5 refs.

The computer program COMFIT calculates the parameters which determine the curve of special type, fitting best to a set of data points. The calculations can be performed at present with the following functions: a linear function; a polynomial function of fixed or free degree; a sum of exponential functions. The program can deal with the situation of random measurement uncertainties in the data points in one direction (X or Y direction) or in both directions. The parameters and their standard deviations are calculated with the least squares method. Values of the goodness-of-fit are also calculated; the program is able to compare the fits obtained for different expressions. The computer program has been written in FORTRAN-4 for a CDC-CYBER-175 computer.

13549 **(FEI—1241) Entry format for representation of analytical relations on the ES computer.** Katan, I.B.; Sal'nikova, O.V.; Blokhin, A.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1981. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703394.

Structure and description of an input format for representation of analytical relations on the ES computer as well as dictionaries of key words and system identificators for thermal-physical and hydraulic data are presented. It is shown that the format con-

sidered can be the basis at the formation of library of analytical relations.

13550 **(LA-UR—82-3322) Computer-controlled data communications test center.** Horning, R.R.; Creel, L.R.; Doll, M.A. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 6p. (CONF-821201—8). NTIS, PC A02/MF A01. Order Number DE83003539.

From Fall DECUS US Symposium; Anaheim, CA, USA (6 Dec 1982).

Portions of document are illegible.

This paper describes the software developed for a computer-based test center used in testing and diagnosing a large network of terminal and remote processor communications links. The software runs in time-base-scheduled and on-demand interactive modes. It includes a control program, several measurement tasks, Datatrieve-11 databases, and various graphical display programs, all running under RSX11M, V4.0, on a PDP-11/70.

13551 **(LA-UR—82-3334) ALECS: assembly language extensions and control structures.** Oothoudt, M.A.; Kozlowski, T. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 5p. (CONF-821201—9). NTIS, PC A02/MF A01. Order Number DE83003534.

From Fall DECUS US Symposium; Anaheim, CA, USA (6 Dec 1982).

ALECS is an assembly language preprocessor allowing the use of structured programming techniques in MACRO-11 code. Programs are written using standard control structures with normal MACRO-11 code embedded as needed. The ALECS task is used to translate the source to pure MACRO-11 source file which is then submitted to the assembler. ALECS also produces a structured source listing showing the true logical flow of code. ALECS has been used for short subroutines as well as RSX-11M I/0 drivers and an ACP.

13552 **(LA-UR—82-3398) Applying the MRV11-C board.** Ford, W.; Barnett, W.C. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 10p. (CONF-821201—7). NTIS, PC A02/MF A01. Order Number DE83003560.

From Fall DECUS US Symposium; Anaheim, CA, USA (6 Dec 1982).

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Hints are given for configuring the MRV11-C board and for programming ROMs. Bootstrap loaders for downloading from ROM to RAM for exceution and example programs using the technique are given.

13553 **(LA-UR—82-3550) VAXMATH: a mathematical software library for the VAX.** Boland, W.R.; Chow, J.; Ford, J.R.; White, A.B. Jr. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 4p. (CONF-821201—11). NTIS, PC A02/MF A01. Order Number DE83004732.

From Fall DECUS US Symposium; Anaheim, CA, USA (6 Dec 1982).

VAXMATH is a large collection of mathematical software for the VAX, based in large part upon the SLATEC Library. Routines in the library represent the state-of-the-art in numerical mathematics and have been thourghly tested. The library is characterized by the inclusion of many easy-to-use routines, the use of a standard error handler, and machine readable documentation. Specific information on how to obtain the software is available.

13554 **(LA-UR—82-3657) LAMAP, the Los Alamos National Laboratory mapping code.** McGavran, L.P.; Wheat, B.M. (Los Alamos National Lab., NM (USA)). 1982. Contract W-7405-ENG-36. 12p. (CONF-830202—1). NTIS, PC A02/MF A01. Order Number DE83004743.

From ISSCO user's group meeting; San Diego, CA, USA (28 Feb 1983).

An interactive computer mapping code, LAMAP, has been developed for the Los Alamos National Laboratory. LAMAP can produce topographic and/or planimetric maps of any area of the Laboratory's 27,800-acre site to any scale. This paper describes briefly the history of the development of the mapping code, the acquisition of the topographic and planimetric data, and the Los Alamos Integrated Computing Network. It also presents a runthrough of LAMAP, highlighting the use of DISSPLA. Finally, a few uses that have been made of LAMAP and some of the additions that have been requested by its users are discussed.

13555 **(LBL—14471) Controlling a radially-connected array of minicomputers.** Meng, J. (Lawrence Berkeley Lab., CA (USA)). May 1982. Contract AC03-76SF00098. 6p. (CONF-821105—6). NTIS, PC A02/MF A01. Order Number DE83003984.

From Asilomar conference; Pacific Grove, CA, USA (8 Nov 1982).

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To connect a radial array of eight minicomputers to a single master minicomputer we have simulated front panel controls, in which switch contacts are electronically made or broken under program control in the master, and data is returned to the master via what normally would be register displays. Experience so far indicates that this means of connecting to an array of minicomputers has many powerful advantages over other more conventional computer array control schemes.

13556 **(LCC—010/81) Library of Modulef subroutines.** Kritz, M.V. (Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil)). Jul 1981. 19p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703390.

The structure and contents of the MTS implementation of Modulef Software, are presented. It contains a short description of the general structure and data flux among Modulef routines, a list of chief-routines (or modules) in each library and a procedure concerning their use. This procedure tells how to concatenate, compile and run some Modulef modules.

13557 **(NUREG/CR—1935) Quantitative fault tree analysis using the Set Evaluation Program (SEP).** Olman, M.D. (Sandia National Labs., Albuquerque, NM (USA)). Sep 1982. Contract AC04-76DP00789. 46p. (SAND—80-2712). NTIS, PC A03/MF A01 - GPO. Order Number DE83003698.

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This report describes the use of a program to aid in the analysis of fault trees. The user has the option of executing one or more of a number of procedures which have been developed to perform the quantitative analysis of a fault tree.

13558 **(PNL-SA—8409) Perturbation method for stochastic operator difference equations.** Gibbs, A.G. (Pacific Northwest Lab., Richland, WA (USA)). Aug 1980. Contract AC06-76RL01830. 32p. (CONF-8009299—1). NTIS, PC A03/MF A01. Order Number DE83002755.

From Systematic comprehensive evaluation and total effectiveness of repositories workshop; Houston, TX, USA (29 Sep 1980).

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The focus of this paper is a set of coupled difference equations in which the matrix operator, the source terms, and the initial solution vector all are imprecisely known. Such a system is shown to arise from the implicit time differencing and spatial discretization of a class of partial differential equations. These equations describe, e.g., contaminant transport in a fluid whose velocity field is imprecisely known. Appropriate norms and spaces are introduced to allow a precise measure of the degree of uncertainty. For the case of small uncertainties, perturbation methods are applied to derive an equation, correct to second order in small quantities, which is satisfied by the mean solution. Conditions for the validity of this result are obtained. Various approximations which may improve computational efficiency or reduce data-storage requirements, based on special properties of the inverse mean operator, are discussed. An expression is derived for the variance of the solution and similar approximations to it are described. The paper concludes with a brief discussion of the main results.

13559 **(PNL-SA—10897) Use of color and motion for the display of multi-dimensional data.** Littlefield, R.J.; Nicholson, W.L. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1982. Contract AC06-76RL01830. 11p. (CONF-821021—3). NTIS, PC A02/MF A01. Order Number DE83003596.

From DOE statistical symposium; Idaho Falls, ID, USA (13 Oct 1982).

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Meaningful display of data structure in more than two dimensions is a challenge to statistical graphics. The Analysis of Large Data Sets project (ALDS) includes research to evaluate potential techniques for displaying higher-dimensional data. This paper describes some of the ALDS developments on the use of color, glyphs, motion and stereo. Color is helpful but not essential. Color can be used for accent, identification of categories, ordered-scale display of a quantitative variable, and reinforcement of geometric cues. Glyphs are useful for extending scatterplots to display additional quantitative variables. Motion is a powerful tool, not only for three-dimensional (3-D) rotation, but also for more general display of distinct images such as slices of a multi-dimensional solid. Stereo is a relatively weak 3-D cue when used by itself, but is useful as an adjunct to other cues such as rotation. Examples illustrate the simultaneous use of color, glyphs, motion, and/or stereo.

13560 **(SAND—82-0930) Non-recursive lowpass digital-filter algorithm.** Spielman, R.B. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01. Order Number DE83004614.

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A non-recursive lowpass filter has been developed for use with waveform data collected with Tektronix 7912 transient digitizers. The filter subroutine is specifically compatible with Tektronix SPS Basic V02XM.02 software.

13561 **(SAND—82-2175) System for developing HP41CV hand-held calculator programs on an HP9845 desktop computer.** Pruett, H.D. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1982. Contract AC04-76DP00789. 14p. NTIS, PC A02/MF A01. Order Number DE83005360.

Portions of document are illegible. Printed copy available until stock is exhausted.

A software development system utilizing the HP9845 desktop computer to facilitate programming of the HP41 hand-held calculator is described and discussed. This system overcomes the two primary deficiencies involved in developing long programs for the HP41, namely, the lack of a typewriter keyboard on the HP41 and the inability to include comments in program lines.

13562 **(SAND—82-2250) UFO (UnFold Operator) computer program abstract.** Kissel, L.; Biggs, F. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 24p. NTIS, PC A02/MF A01. Order Number DE83004767.

UFO (UnFold Operator) is an interactive user-oriented computer program designed to solve a wide range of problems commonly encountered in physical measurements. This document provides a summary of the capabilities of version 3A of UFO.

13563 **(SAND—82-2357) Monotone Boolean approximation.** Hulme, B.L. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 15p. NTIS, PC A02/MF A01. Order Number DE83004764.

Portions of document are illegible. Printed copy available until stock is exhausted.

This report presents a theory of approximation of arbitrary Boolean functions by simpler, monotone functions. Monotone increasing functions can be expressed without the use of complements. Nonconstant monotone increasing functions are important in their own right since they model a special class of systems known as coherent systems. It is shown here that when Boolean expressions for noncoherent systems become too large to treat exactly, then monotone approximations are easily defined. The algorithms proposed here not only provide simpler formulas but also produce best possible upper and lower monotone bounds for any Boolean function. This theory has practical application for the analysis of noncoherent fault trees and event tree sequences.

13564 **(SLAC-PUB—2972) I/O register to FASTBUS interface.** Logg, C.A.; Paffrath, L. (Stanford Linear Accelerator Center, CA (USA)). Sep 1982. Contract AC03-76SF00515. 4p. (CONF-821011—36). NTIS, PC A02/MF A01. Order Number DE83004390.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

An input/output register to FASTBUS interface (IORFI) has been designed which provides an inexpensive and simple means to connect a computer to a FASTBUS backplane segment. The FASTBUS interface is built on a single width FASTBUS module. It is connected to a computer by two 16-bit parallel input registers and two 16-bit parallel output registers, which makes the interface computer-non-specific. This paper describes the operational characteristics of this interface, its advantages, limitations, and briefly, the uses to which it has been put.

13565 **(SLAC-PUB—2995) Software for managing multi-crate FASTBUS Systems.** Deiss, S.R.; Gustavson, D.B. (Stanford Linear Accelerator Center, CA (USA)). Oct 1982. Contract AC03-76SF00515. 5p. (CONF-821011—28). NTIS, PC A02/MF A01. Order Number DE83004154.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

Portions of document are illegible.

The FASTBUS System Manager software that was designed and implemented on an LSI-11 system using PASCAL is described. Particular attention is given to the file structures, file access mechanisms, and basic routing algorithms. Portability to other machines and languages is described.

13566 **(SLAC-PUB—2996) Fastbus software progress.** Gustavson, D.B. (Stanford Linear Accelerator Center, CA (USA)). 1982. Contract AC03-76SF00515. 2p. (CONF-821001—35). NTIS, PC A02/MF A01. Order Number DE83004419.

From STTFUA high-intensity solar flux measuring techniques workshop; Albuquerque, NM, USA (26 Oct 1982).

The current status of the Fastbus software development program of the Fastbus Software Working Group is reported, and future plans are discussed. A package of Fastbus interface subroutines has been prepared as a proposed standard, language support for diagnostics and bench testing has been developed, and new documentation to help users find these resources and use them effectively is being written.

13567 **(UCID—19637) NLTSS/LINCS for a presentation to Nuclear Software Systems Division.** Athey, C. III; Crispin, K.; Du Bois, P.; Mecozzi, D.; Minton, J. (Lawrence Livermore National Lab., CA (USA)). 30 Nov 1982. Contract W-7405-ENG-48. 36p. NTIS, PC A03/MF A01. Order Number DE83005032.

NLTSS is a group of server processes and a message system kernel which can reside on a CRAY-1 computer and provide the functionality of a local operating system, plus the capability for distributed computing. NLTSS can incorporate access to new network resources more easily than can LTSS. The external aspects of the NLTSS system will initially be constrained to resemble those of LTSS. NLTSS interactive terminal commands will be the same as LTSS commands, when possible, similar if sameness isn't possible, and in some instances omitted. The latter category is comprised of LTSS-specific inquiries. Libraries are being designed and implemented by USD to provide a BASELIB-like interface to the system. Generally, the system primitives need not be well understood by the application-level user. There are some differences; e.g., a process and a file are different kinds of objects. The method for accessing each is generally the same, however. This difference should be largely hidden from the high-level user. Another example, the dollar accounting control (the alpha codes; e.g., ACD) is more rigorously managed, and resource usage more completely reported.

13568 **(UCRL—88359) LINCS: Livermore's network architecture.** Fletcher, J.G. (Lawrence Livermore National Lab., CA (USA)). 1982. Contract W-7405-ENG-48. 5p. (CONF-821201—6). NTIS, PC A02/MF A01. Order Number DE83004141.

From Fall DECUS US Symposium; Anaheim, CA, USA (6 Dec 1982).

Octopus, a local computing network that has been evolving at the Lawrence Livermore National Laboratory for over fifteen years, is currently undergoing a major revision. The primary purpose of the revision is to consolidate and redefine the variety of conventions and formats, which have grown up over the years, into a single standard family of protocols, the Livermore Interactive Network Communication Standard (LINCS). This standard treats the entire network as a single distributed operating system such that access to a computing resource is obtained in a single way, whether that resource is local (on the same computer as the accessing process) or remote (on another computer). LINCS encompasses not only communication but also such issues as the relationship of customer to server processes and the structure, naming, and protection of resources. The discussion includes: an overview of the Livermore user community and computing hardware, the functions and structure of each of the seven layers of LINCS protocol, the reasons why we have designed our own protocols and why we are dissatisfied by the directions that current protocol standards are taking.

13569 **(UCRL—88475) Development of a multimaterial, two-dimensional, arbitrary Lagrangian-Eulerian mesh computer program.** Barton, R.T. (Lawrence Livermore National Lab., CA (USA)). 11 Oct 1982. Contract W-7405-ENG-48. 27p. (CONF-8210111—). NTIS, PC A02/MF A01. Order Number DE83004805.

From Numerical astrophysics meeting; Urbana, Israel (21 Oct 1982).

Portions of document are illegible.

We have developed a large, multimaterial, two-dimensional Arbitrary Lagrangian-Eulerian (ALE) computer program. The special feature of an ALE mesh is that it can be either an embedded Lagrangian mesh, a fixed Eulerian mesh, or a partially embedded, partially remapped mesh. Remapping is used to remove Lagrangian mesh distortion. This general purpose program has been used for astrophysical modeling, under the guidance of James R. Wilson. The rationale behind the development of this program will be used to highlight several important issues in program design.

13570 **Advanced implementation of the Dantzig-Wolfe decomposition algorithm for linear programming.** Ho, J.K. (Brookhaven National Lab., Upton, NY); Loute, E. *Mathematical Programming Study;* 20: 303-326(1981). Contract AC02-76CH00016.

Since the original work of Dantzig and Wolfe in 1960, the idea of decomposition has persisted as an attractive approach to large-scale linear programming. However, empirical experience reported in the literature over the years has not been encouraging enough to stimulate practical application. Recent experiments indicate that much improvement is possible through advanced implementations and careful selection of computational strategies. This paper describes such an effort based on state-of-the-art, modular linear programming software (IBM's MPSX/370).

9903 Information Handling

REFER ALSO TO CITATION(S) 13296

13571 **(IAEA-NDS—7(Rev.1)) Index of nuclear data libraries available from the IAEA Nuclear Data Section.** Lemmel, H.D. (International Atomic Energy Agency, Vienna (Austria). Nuclear Data Section). Feb 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703062.

This document lists more than 50 nuclear data libraries together with references that give more detailed information about these libraries. All data and documentation references are available, free of charge, from the IAEA Nuclear Data Section.

CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

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DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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Land use/mineral rights map series, 8:13072 (R;US)

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Application of the electron-cyclotron resonance source to Lamb-shift polarized ion sources, 8:13235 (R;US)

Alliance to Save Energy, Washington, DC (USA)
Third-party financing: increasing investment in energy-efficient industrial projects, 8:12618 (R;US)

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Feasibility study of the production and use of wood-derived fuels in a large chemical plant. Final report, 8:12052 (R;US)

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Adventures in joint ventures: issues facing attorneys and managers in joint-action power projects, 8:12503 (R;US)
Electric utilities and natural gas use, 8:12484 (R;US)
Energy diversion: theft of electricity, 8:12498 (R;US)
Hydroelectric power: renewed emphasis and expanded opportunities, 8:11995 (R;US)
Legal remedies for theft of electricity, 8:12502 (R;US)
Nashville Electric Service cogeneration energy-recovery facility, 8:12626 (R;US)
PURPA - small power production/cogeneration: implementing problems for the utility, 8:12500 (R;US)
Selected antitrust issues in utility fuels and equipment purchases, 8:12499 (R;US)
Some aspects of utility obligation to serve new retail loads, 8:12501 (R;US)

Ames Lab., IA (USA)
Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen, and vanadium alloys, 8:12712 (R;US)
Adsorption of ethanol and water vapor by Silicalite, a hydrophobic molecular sieve, 8:12061 (R;US)
Asymptotic formulas for elliptic integrals, 8:13417 (R;US)
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R;US)
Binderless briquetting of coal powders by an acetone treatment process, 8:11757 (R;US)
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R;US)
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R;US)
Direct determination of organic sulfur in coal by electron-beam microanalysis, 8:11677 (R;US)
Dynamic Monte Carlo simulation of the one-dimensional Potts model, 8:13403 (R;US)
Effect of stress on the transformation in nickel-titanium, 8:12677 (R;US)
Electrical properties of WSe_2, WS_2, $MoSe_2$, MoS_2, and their use as photoanodes in a semiconductor/liquid junction solar cell, 8:12062 (R;US)
Electron-energy-loss and ultraviolet-photoemission study of VN/sub x/, NbN/sub x/, and ZrN/sub x/, 8:12711 (R;US)
Electronic structure of hcp lutetium, 8:12678 (R;US)
Fluorescence-line-narrowing spectrometry of polycyclic aromatic hydrocarbons in organic glasses, 8:12755 (R;US)
Formation of helium-gas bubbles in the vanadium-titanium binary and ternary alloys irradiated by energetic Ni^{++} ions, 8:12674 (R;US)
Forward dimuons from πN interactions at Fermilab: design and construction of a scintillation-counter hodoscope, 8:13278 (R;US)
Halide and chalcogenide clusters of the early transition metals, 8:12784 (R;US)
Hydrogen and deuterium diffusion in vanadium alloys, 8:12676 (R;US)
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R;US)

Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R;US)
Irreversible cooperative processes on lattices, 8:12790 (R;US)
Kinetic and mechanistic studies of the reactions of selected aliphatic radicals with metal complexes and the decomposition of organoperoxy cobalt complexes, 8:12788 (R;US)
Kinetic studies of organocobalt compounds related to vitamin B_{12} coenzymes, 8:12786 (R;US)
Kinetics and mechanism of methanol decomposition over zinc oxide, 8:11982 (R;US)
Kinetics and mechanisms of the reactions of aliphatic free radicals with organocobaloximes and fluoropentaamminecobalt(III) ion, and of iron(III) with methylrhodoxime, 8:12789 (R;US)
Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen, 8:12787 (R;US)
Laser excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons, 8:12758 (R;US)
Laser-excited atomic-fluorescence spectrometery as a tool for chemical analysis, 8:12756 (R;US)
Magnetic susceptibility of scandium-hydrogen and lutetium-hydrogen solid-solution alloys from 2 to 300°K, 8:12681 (R;US)
Magnetic-resonance studies of reactively sputtered amorphous silicon-hydrogen alloys, 8:12739 (R;US)
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R;US)
Moessbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces, 8:12675 (R;US)
Molecular-beam photoionization studies of molecules and their van der Waals clusters, 8:12815 (R;US)
NDE programs at the Ames Laboratory and Iowa State University, 8:12880 (R;US)
New analytical techniques for mycotoxins in complex organic matrices, 8:12757 (R;US)
Nonphotochemical hole burning and the nature of amorphous solids, 8:12737 (R;US)
Partial-equilibrium model based on the kinetics of dissolution and equilibrium in solution of the UO_2-FeS_2-$Fe_2(SO_4)_3$-H_2SO_4 system, 8:12823 (R;US)
Phi production and the OZI rule in π^+ d interactions at 10 GeV/c, 8:13263 (R;US)
Photoemission study of the 4f character in gamma- and alpha-cerium, 8:12680 (R;US)
Simplified analysis of shells with local, impulsive loads, 8:12402 (R;US)
Spin-lattice relaxation of protons in scandium dihydride, 8:12713 (R;US)
Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_3Mo_2Cl_8H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters, 8:12785 (R;US)
Study of the anomalous behavior of the electrical resistivity in alloys near the $PrNi_{5.0}$ composition, 8:12682 (R;US)
Study of the electrowinning of copper using a fluidized-bed electrochemical reactor, 8:12679 (R;US)
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R;US)
Superconductivity and low-temperature phases of Cu/sub x/Mo_6Se_8, 8:12738 (R;US)
Synthesis and characterization of oxide interstitial derivatives of zirconium monochloride and monobromide, 8:12791 (R;US)

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Neutron physics. Pt. 4, 8:13435 (R;SU;RU)
Organic chemistry and technology of organic substances. Bioorganic chemistry and biochemistry. Chemistry and technology of high-molecular compounds. Vol. 2, 8:12806 (R;SU;RU)
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Fast-neutron elastic-scattering cross sections of elemental tin, 8:13320 (R;US)
Fast-neutron total and scattering cross sections of ^{103}Rh, 8:13319 (R;US)
Fission-fragment angular distributions and total kinetic energies for ^{235}U(n,f) from .18 to 8.83 MeV, 8:13348 (R;US)
Mass and mutagenicity balances in chemical fractionations, 8:13178 (R;US)
Physics Division annual review, 1 April 1980-31 March 1981, 8:13293 (R;US)
Pumped-storage hydroelectric plants with underground lower reservoirs, 8:12450 (R;US)
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Geothermal development plan: Cochise/Santa Cruz Counties, 8:12234 (R;US)
Geothermal development plan: Graham/Greenlee Counties, 8:12236 (R;US)
Geothermal development plan: Maricopa County, 8:12230 (R;US)
Geothermal development plan: northern Arizona counties, 8:12232 (R;US)
Geothermal development plan: Pima County, 8:12231 (R;US)
Geothermal development plan: Pinal County, 8:12233 (R;US)
Geothermal development plan: Yuma County, 8:12235 (R;US)
Potential of utilization of geothermal energy in Arizona. Executive summary, 8:12185 (R;US)

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Methodology for the inspection of items important to safety. The Canadian approach, 8:12399 (R;CA)
Role of regulatory body related to siting, 8:12365 (R;CA)

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Analysis of waste-package behavior for high-level waste, 8:11910 (R;US)
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ONWI library reports list, 8:11892 (R;US)
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Bendix CAD-CAM site plan, 8:13538 (R;US)
Evaluation of coordinate measuring machines, 8:13005 (R;US)
Method for the preparation of polymers, 8:12729 (TG;US)
Neutron-shielding material. Translated from the Japanese, 8:13374 (R;US)
Synthesis and characterization of diallyl phthalate prepolymers, 8:12722 (R;US)
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Determination of surface area of glass grains by adsorption of methylene blue and its application in the testing of relative impact strength of glasses, 8:12730 (R;IN)
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Boeing Computer Services Co., Seattle, WA (USA)
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Impacts of alternative-engine technology on the refining industry, 8:11809 (R;US)
Brandeis Univ., Waltham, MA (USA)
Search for production of narrow p anti p states with a 5 GeV/c p beam, 8:13254 (R;US)
Bremen Univ. (Germany, F.R.)
Development of a multiwire proportional chamber for nanodosimetry measurement of the energy deposition of alpha particles in smallest sensitive volumina, 8:12964 (R;DE;In German)
Brigham Young Univ., Provo, UT (USA)
Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R;US)
Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982, 8:11645 (R;US)
Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry
Separation of asphaltenes using high-resolution supercritical-fluid chromatography. Progress report, September 1-November 30, 1982, 8:12750 (R;US)
British Columbia Univ., Vancouver (Canada). TRIUMF Facility
Application of the electron-cyclotron resonance source to Lamb-shift polarized ion sources, 8:13235 (R;US)
TRIUMF: scientific activities annual report, 1980, 8:12929 (R;CA)
British Gas Corp., London
Development of new combustion control equipment. Application to a modern range of gas burners and the resulting savings.

The move towards permanent closed loop combustion control, 8:12893 (TG;GB)
Investigations and experiments by SNAM on the interchangeability of gases, 8:11823 (TG;GB)
Method for the preparation of a gaseous fuel, 8:11991 (TG;GB)

Brock and Blevins Co., Inc., Roosville, GA (USA)
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Brookhaven National Lab., Upton, NY (USA)
Advanced chemistry and materials for fuel cells, 8:12520 (R;US)
Analysis of gas purification by heatless adsorption, 8:12748 (R;US)
Applications of nuclear technologies for in-vivo elemental analysis, 8:13059 (R;US)
Automated flow microfluorometer and cell sorter incorporating nuclear electronics, 8:13117 (R;US)
Brookhaven free-electron laser experiment, 8:12937 (R;US)
Characteristics of thermoluminescence glow curves for materials exhibiting more than one glow peak, 8:12818 (R;US)
Charge collection in silicon strip detectors, 8:12943 (R;US)
Comparing the health and environmental hazards of different energy systems, 8:13100 (R;US)
Container assessment: corrosion study of HLW container materials. Quarterly progress report, January-March 1982, 8:12686 (R;US)
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R;US)
Effects of ternary additions on Young's modulus and the martensitic transformation of Nb_3Sn, 8:12659 (R;US)
ENDF/B fission-product data, 8:13321 (R;US)
Enhancement of radiopharmaceutical excretion by chemical interventions, 8:13176 (R;US)
Evidence for glueballs, 8:13267 (R;US)
Experiment control and data-acquisition system for the biology small-angle x-ray-scattering station, 8:12939 (R;US)
Final design and status of the NSLS vacuum system, 8:12938 (R;US)
General-purpose stepping motor-encoder positioning subsystem with standard asynchronous serial-line interface, 8:12911 (R;US)
High energy e^+-e^- collider using an inverse free electron laser accelerator, 8:12894 (R;US)
High-resolution x-ray scattering, 8:12913 (R;US)
Introduction to the Central Scientific Computing Facilities, 8:13539 (R;US)
Lattice gauge theories, 8:13283 (R;US)
Long-range interaction of small soot particles, 8:13018 (R;US)
Measurement of nu/sub e/ and anti nu/sub e/ elastic scattering as a test of the standard model, 8:13253 (R;US)
MONEX79 atmospheric boundary-layer experiment over the Bay of Bengal: Digha data report, 8:13019 (R;US)
One-dimensional numerical simulation of a free-electron laser - storage-ring system, 8:12864 (R;US)
Physical basis for prompt-neutron activation analysis, 8:12749 (R;US)
Production of spallation radionuclides for medical applications at BLIP, 8:12912 (R;US)
Research using synchrotron radiation at the National Synchrotron Light Source, 8:12910 (R;US)
Search for new heavy techniparticles, 8:13268 (R;US)
Search for production of narrow p anti p states with a 5 GeV/c p beam, 8:13254 (R;US)
Simple method for estimating the maximum value of developing new electric power generation technologies, 8:12497 (R;US)
Standard model group, QCD subgroup - dynamics isolating and testing the elementary QCD subprocess, 8:13284 (R;US)
Thermoluminescence of the mineral components in granite, 8:13216 (R;US)
Why QCD lattice theory is important to spin physicists, 8:13285 (R;US)
Workshop on acceleration of polarized protons: summary report, 8:12899 (R;US)
Zinc-electrode morphology in acid-battery electrolytes, 8:12458 (R;US)

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C

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Tools for developing software for different types of microprocessors, to be used, in particular, for the acquisition and processing of nuclear data, 8:13542 (R;FR;In French)
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Active electrodes to be used in advanced alkaline-water electrolysis, 8:11954 (R;BE)
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Study of transition boiling phenomena with saturated water at 1-4 bar, 8:12874 (D;US)
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Colorado School of Mines, Golden (USA)
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Search for new heavy techniparticles, 8:13268 (R;US)
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Fluid-structure coupling in Lagrange-Lagrange and Euler-Lagrange descriptions, 8:12392 (R;XE)
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International safeguards data-management system, 8:11935 (R;XE)
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Planning of a C-band-pulse-Doppler-radar with polarization diversity for atmospheric research in the meso-scale range, 8:13021 (R;DE;In German)
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Analysis of the energy weighted angular correlations in hadronic e^+e^- annihilations at 22 and 34 GeV, 8:13255 (R;DE)
Application of Gegenbauer integration method to e^+e^- annihilation process, 8:13270 (R;DE)
Double excitation structure in the L-edge X-ray absorption spectra of α-cerium, 8:12662 (R;DE)
Geodetic control surveys at PETRA, 1981/1982, 8:12941 (TG;US)
Gluonium and QCD in the J/psi region, 8:13280 (R;US)
Partial cross sections and density of states effects in the valence band photoemission from solid nitrogen, 8:12732 (R;DE)
Search for charged scalar particles pair produced in e^+e^- annihilation, 8:13256 (R;DE)
SU(3) lattice Monte Carlo calculation of the glueball mass spectrum, 8:13269 (R;DE)
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Additional Pu-238 production, 8:11952 (R;US)
Cesium glass irradiation sources, 8:11947 (R;US)
Characterization of borosilicate glass containing Savannah River Plant radioactive waste, 8:11878 (R;US)
Efficient particulate scrubber for glass melter off-gas, 8:11880 (R;US)
Evaluation of uranium geochemical anomalies in the Charlotte 1° x 2° NTMS quadrangle, 8:11829 (R;US)
Heat treating effects on environmental hydrogen embrittlement of nickel, 8:12669 (R;US)
Isotope-dilution analyses of the metallic elements, 8:12752 (R;US)
Occurrence of American shad eggs in 1G cooling-water canal, 8:13096 (R;US)
Pilot solid-waste incinerator, 8:11877 (R;US)

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Savannah River Laboratory local area computer network, 8:13547 (R;US)
SRL incinerator components test facility, 8:11876 (R;US)
Strontium-90 and promethium-147 recovery, 8:11951 (R;US)
Surface studies of iridium-alloy grain boundaries associated with weld cracking, 8:11949 (R;US)
Theoretical predictions for continuous-slurry feeding of a glass melter, 8:11879 (R;US)

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Accident Sequence Evaluation Program, 8:12388 (R;US)
Aerial radiological survey of the Argonne National Laboratory and surrounding area, Argonne, Illinois. Date of survey: May 1977, 8:13064 (R;US)
Aerial radiological survey of the Comanche Peak Steam Electric Station and surrounding area, Glen Rose, Texas. Date of Survey: March 1982, 8:13039 (R;US)
CONTEMPT 4/MOD 3: a multicompartment containment system analysis program, 8:12412 (R;US)
Directions in low-level radioactive-waste management, 8:11868 (R;US)
Effects of coal-gasification atmospheres on pressurized tubes, 8:11647 (R;US)
Flaw characterization with ultrasonic phase and frequency information, 8:12879 (R;US)
GAUSS VII: a computer program for the analysis of γ-ray spectra from Ge semiconductor spectrometers, 8:12948 (R;US)
Research and disposition of highly loaded organic resins, 8:11883 (R;US)
Safety analysis of Kuosheng Mark III SRV piping response to discharge loading, 8:12289 (R;US)
Ultrasonic detection of molten/solid interfaces of weld pools, 8:12670 (R;US)
Waste classification system for low-level radioactive wastes, 8:11882 (R;US)

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Dynamical properties of charge-dividing proportional counters, 8:12945 (R;XC)
Erigone bus study, 8:13543 (R;XC)
Radiation-resistent magnets, 8:12914 (R;XC)

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Charged-hyperon production by 400-GeV/c protons, 8:13260 (R;US)
Dimuon production in hadronic interactions, 8:13258 (R;US)
Integrability, duality, monodromy, and the structure of Bethe's ansatz, 8:13405 (R;US)
Jets: models versus experimental data, I, 8:13276 (R;US)
Structural analysis of the CDF transporter cart, 8:12917 (R;US)
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Interior's minerals-management programs need consolidation to improve accountability and control, 8:12488 (R;US)
Response to questions raised concerning TMI-2 cleanup schedule and cost, 8:12393 (R;US)

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Obstacles to US ability to control and track weapons-grade uranium supplied abroad, 8:11936 (R;US)

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ICRF antenna coupling studies, 8:13478 (R;US)
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Mode converters used in the Doublet III ech microwave system, 8:13477 (R;US)

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Fuel-rod vibration in two-phase flow, 8:12291 (R;US)

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Screening of three proposed DOE geopressured-geothermal aquifer natural gas project areas for potential conflicting commercial production: Freshwater Bayou, Lake Theriot, and Kaplan, Louisiana, 8:12200 (R;US)

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Calculations for LOFT experiment L3-1 with the homogeneous version of the computer code DRUFAN, 8:12396 (R;DE;GE)
First comparison of the results of standard problems carried out in the blowdown region, 8:12397 (R;DE;GE)
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4 π physics with the plastic ball, 8:13297 (R;US)
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Numerical solution of partial differential equations of physics. Pt. 2, 8:13415 (R;DE;In German)
Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow
Neutron physics. Pt. 4, 8:13435 (R;SU;RU)
Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii
Multigroup program for calculating the thermal neutron utilization factor in multizone cylindrical reactor cell (MGPRAKTINETs), 8:12340 (R;SU;In Russian)
Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki
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Irreversible processes in a binary system of an electron cooling channel, 8:12900 (R;SU;In Russian)
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Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij
FORTRAN preprocessor in the booster synchrotron control system, 8:12918 (R;SU;In Russian)
MULTIC program for computing three-dimensional magnetic fields of superconducting magnets, 8:12847 (R;SU;In Russian)
Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules
Measurement methods for high energy particle identification in gaseous mixture detectors, 8:12972 (R;FR;In French)
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SAMSS: computer-aid system for the preparation of social-science models. Reference and implementation instruction manual. Final report, 8:13097 (R;XE)
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Grumman Aerospace Corp., Bethpage, NY (USA)
Three equipment concepts for the Fusion Engineering Device, 8:13465 (R;US)
Grumman Aerospace Corp., Princeton, NJ (USA)
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H

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Calibration of SSTR neutron dosimetry for TMI-2 applications, 8:12398 (R;US)
Defect production in simulated cascades: cascade quenching and short-term annealing, 8:13481 (R;US)
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R;US)
Improved specifications for fast reactor fuel, 8:12370 (R;US)
Remote-handling demonstration tests for the Fusion Materials Irradiation Test (FMIT) Facility, 8:13482 (R;US)
Safeguards through secure automated fabrication, 8:11937 (R;US)
Hanford Environmental Health Foundation, Richland, WA (USA)
1976 Hanford Americium exposure incident: hematologic effects, 8:13149 (R;US)
1976 Hanford americium exposure incident: in vivo measurements, 8:13147 (R;US)
1976 Hanford americium exposure incident: medical management and chelation therapy, 8:13143 (R;US)
1976 Hanford americium exposure incident: psychological aspects, 8:13144 (R;US)
1976 Hanford americium-exposure incident: decontamination and treatment facility, 8:13146 (R;US)
1976 Hanford americium-exposure incident: external decontamination procedures, 8:13145 (R;US)
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Attenuation of photon beams from radionuclides. Pt. 6, 8:13373 (R;DE;In German)
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Effect of physical characteristics on heat transfer over a gas free-flowing interface, 8:12384 (R;DE;GE)
Experimental study of heat transfer in 1- and 2-layered fluid systems perfused by gas and containing internal heat sources, 8:12385 (R;DE;GE)
Heat transfer and fragmentation during contact between a gas-covered melt and cooling liquid, 8:12386 (R;DE;GE)
Phase separation. Final report, 8:12383 (R;DE;GE)
Hansen (Derek) and Associates, Inc., San Francisco, CA (USA)
Financing conservation and renewable energy in the eighties, 8:12548 (R;US)
Harmon Engineering and Test Co., Inc., Auburn, AL (USA)
Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Market survey and economic analysis, 8:11978 (R;US)
Fensibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 4. Environmental, health, safety, and socioeconomic assessment, 8:11980 (R;US)
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Optimization of transparent electrode for solar cell. Technical report, 15 September 1981-14 September 1982, 8:12094 (R;US)
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Neutrino mixing in grand unified models, 8:13271 (R;US)

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Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11839 (R;US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11841 (R;US)
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I

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Coincident inspection: FY-82 report, 8:12878 (R;US)
Earthquake catalog for the eastern Snake River Plain region, Idaho (43.0°-44.5°N, 111.5°-114.0°W), October 1972-June 1982, 8:13209 (R;US)
NRC/DAE reactor safety research Data Bank, 8:12387 (R;US)
Raffle V general purpose Monte Carlo code for neutron and gamma transport, 8:12339 (R;US)
Technical assessment of radiation overexposures at Three Mile Island from the August 28, 1979, entry into the Unit 2 Fuel-Handling Building Makeup Valve Room, 8:12389 (R;US)
Technical plan for the development of an assay system for INEL-stored TRU waste, 8:11933 (R;US)
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Orientation of ceramic microstructures by hot-forming methods, 8:12707 (R;US)

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Burn dynamic experiment based on the field-reversed theta pinch, 8:13466 (R;US)
Computational simulation of spheromak plasma heating, 8:13420 (R;US)
Velocity-space particle loss in field-reversed configurations, 8:13419 (R;US)

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Comments on gauge hierarchies, 8:13282 (R;BR)

Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)
Activity determination by a 4π-γ well-type ionization chamber, 8:12967 (R;BR)
Dosimetric characteristics and radiation monitoring with $CaSO_4$(Dy):NaCl pellets, 8:12966 (R;BR)
Introduction to current modeling techniques in nuclear fuel performance analysis, 8:12356 (R;BR)
Studies of alpha particle registration in LR-115 type II. A solid state nuclear track detector, 8:12965 (R;BR)
Survey on fuel pellet cracking and healing phenomena in reactor operation, 8:12357 (R;BR)

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Index of nuclear data libraries available from the IAEA Nuclear Data Section, 8:13571 (R;XA)
PNESD proton nucleus elastic scattering data. Contents and documentation, 8:13296 (R;XA)

International Engineering Co., Inc., San Francisco, CA (USA)
Cerro Prieto geothermal field: exploration during exploitation, 8:12199 (R;US)
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Iowa State Univ. of Science and Technology, Ames (USA)
Charged-hyperon production by 400-GeV/c protons, 8:13260 (R;US)
Development and application of a methodology for the analysis of significant human related event trends in nuclear power plants, 8:12441 (D;US)
Reliability and system analysis of nuclear desalination plants based on operation experience, 8:12288 (D;US)
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NDE programs at the Ames Laboratory and Iowa State University, 8:12880 (R;US)
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Confinement and hadron-hadron interactions by general relativistic methods, 8:13277 (R;IT)
Shape of tachyons, 8:13406 (R;IT)
Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati
Physics with the MAC detector, 8:12940 (R;US)
Istituto Nazionale di Fisica Nucleare, Genoa (Italy)
Surface waves in α-nuclei elastic scattering, 8:13303 (R;IT)
Istituto Nazionale di Fisica Nucleare, Milan (Italy)
Conceptual design of the electronic controls for the RF cavity of the Milan Superconducting Cyclotron, 8:12919 (R;IT)

J

Jacobson (Ray O.), Pengilly, MN (USA)
Report of investigation for hydroelectric generation. Final report, 8:11996 (R;US)
Japan Atomic Energy Research Inst., Tokyo
Graphite limiter and armor damage in Doublet III, 8:13476 (R;US)
Jednota Ceskoslovenskych Matematiku a Fyziku, Ostrava
Sixth conference of Czechoslovak physicists. Part 1. Volume 1, 8:13225 (R;CS;CZ)
Sixth conference of Czechoslovak physicists. Part 1. Vol. 2, 8:13223 (R;CS;CZ)
Sixth conference of Czechoslovak physicists. Part 2, 8:13224 (R;CS;CZ)
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Jet Propulsion Lab., Pasadena, CA (USA)
Advanced Coal-Extraction-Systems Project: report of activities for fiscal year 1980-1981, 8:11716 (R;US)
Cloud-cover estimation: use of GOES imagery in development of cloud-cover data base for insolation assessment, 8:12012 (R;US)
Photovoltaics: state-of-knowledge survey of environmental, health and safety aspects, 8:12046 (R;US)
Study of the United States coal resources, 8:11717 (R;US)
Survey of manufacturers of solar-thermal-energy systems, 8:12179 (R;US)
Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment, 8:12459 (R;US)
Tests of a two-stage, axial-flow, two-phase turbine, 8:12240 (R;US)
Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics
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Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.
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Magnetic system of induction section for accelerating an electron-ion ring, 8:12903 (R;SU;In Russian)
Structure of transition radiation of the electron bunch moving through plane screens, 8:13377 (R;SU;In Russian)
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation
Convergence of a difference approximation of self-consistent system of Maxwell equations on a class of discontinuous solutions, 8:12904 (R;SU;In Russian)
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy
Facility for measurements of fragmentation spectra of relativistic deuterons and alpha particles, 8:12921 (R;SU;In Russian)
Investigation of ionization efficiency in the "Krion-1" electron-beam source, 8:12923 (R;SU;In Russian)
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems
Deuteron cyclotron complex on the base of superconducting sector magnets, 8:12895 (R;SU;In Russian)
Elimination of ambiguity in determining track space orientation in multigap projection spark chambers, 8:12970 (R;SU;In Russian)
Magnetic field shaping for the JINR phasotron, 8:12902 (R;SU;In Russian)
Study on the supercyclotron cavity model excitation, 8:12920 (R;SU;In Russian)
Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions
Study on laser plasma as a source of multicharged ions for cyclotrons in the light element range (Li,Be,C), 8:12922 (R;SU;In Russian)
Jones and Stokes Associates, Inc., Sacramento, CA (USA)
Ecological characterization of the central and northern California coastal region. Volume II, Part 2. Species, 8:13053 (R;US)
Ecological characterization of the central and northern California coastal region. Volume III, Part 1. Habitats, 8:13054 (R;US)
Ecological characterization of the central and northern California coastal regtion. Volume II, Part 1. Regional characterization, 8:13068 (R;US)
Ecological characterization of the central and northern California coastal region. Volume IV. Watersheds and basins. Chapters 1-16, 8:13070 (R;US)
Ecological characterization of the central and northern Californa coastal region. Volume IV. Watersheds and basins. Chapters 17-29, 8:13071 (R;US)
Ecological characterization of the central and northern California coastal region. Volume III, Part 2. Community composition lists, 8:13069 (R;US)
Juniata Coll., Huntingdon, PA (USA)
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K

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Thermal stability of ion-exchange resins, 8:11912 (R;SE)
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A model for optimal design of district heating networks, 8:12641 (R;US)
Lawrence Berkeley Lab., CA (USA)
4 π physics with the plastic ball, 8:13297 (R;US)
Advanced medical accelerator design, 8:12925 (R;US)
Antiproton production and accumulation for a 20-TeV anti pp collider, 8:12907 (R;US)
Controlling a radially-connected array of minicomputers, 8:13555 (R;US)
Design conditions for fail-safe quenching of a high-current-density superconducting solenoid with a shorted secondary circuit, 8:12852 (R;US)

Design philosophy for high-resolution rate and throughput spectroscopy systems, 8:13443 (R;US)
Energy-efficient compact screw-in fluorescent lamp. Final report, 8:12562 (R;US)
High-purity germanium crystal growing, 8:12974 (R;US)
HISS spectrometer at the Bevalac, 8:13265 (R;US)
Initial wall conditioning in Doublet III, 8:13479 (R;US)
Integrated-circuit control for two-lamp electronic ballast. Final report, 8:12561 (R;US)
Laser-based multiparameter system for automatic sorting of microscopic particles, 8:13183 (R;US)
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Mathematical representation of size and electronic factors, 8:13404 (R;US)
Nuclear-deformation energies according to a liquid-drop model with a sharp surface, 8:13335 (R;US)
Physics with linear colliders in the TeV CM energy region, 8:12897 (R;US)
RFQ development at LBL, 8:12896 (R;US)
Selected epidemiological observations of cell-specific leukemia mortality in the USA, 1969-1977, 8:13138 (R;US)
Simple multifunction discriminator for multichannel triggers, 8:12973 (R;US)
Thermodynamic properties of chemical species in nuclear waste, 8:12825 (R;US)
Thermodynamic properties of strongly nonideal fluid mixtures from an extended quasi-chemical theory, 8:12792 (R;US)
Topics in phenomenology of unified gauge theories of weak, electromagnetic, and strong interactions, 8:13289 (R;US)

Lawrence Livermore National Lab., CA (USA)
Airborne-temperature-survey maps of heat-flow anomalies for exploration geology, 8:12202 (R;US)
Analysis and comparison of automotive-propulsion systems, 8:12643 (R;US)
Analysis and comparison of automotive-propulsion systems, 8:12647 (R;US)
Automated core-test experiment, 8:13016 (R;US)
Changing MFTF vacuum environment, 8:13498 (R;US)
Coating Processes Group progress report, September-October 1982, 8:12690 (R;US)
Control of information as an element of nuclear safeguards, 8:11942 (R;US)
Curing behavior of seven segmented polyurethane adhesives, 8:12728 (R;US)
Damping in building structured during earthquakes: test data and modeling, 8:12854 (R;US)
DDCMP protocol on a DMA serial-line board, 8:13008 (R;US)
Development of a multimaterial, two-dimensional, arbitrary Lagrangian-Eulerian mesh computer program, 8:13569 (R;US)
Development of data-acquisition-and-analysis systems for in-beam gamma-ray spectroscopy: a study of the nucleus ^{180}W, 8:13343 (R;US)
Division of Materials Science (DMS) meeting presentation, 8:12742 (R;US)
Effects of boundary conditions on thermomechanical calculations: Spent fuel test - climax, 8:11913 (R;US)
Effects of earthquake-rupture shallowness and local soil conditions on simulated ground motions, 8:13212 (R;US)
Energy and technology review, 8:11663 (R;US)
Evaluation of the use of HiSil 233 in silicone elastomers and cellular silicones, 8:12727 (R;US)
Experimental and calculational results from the Spent Fuel Test-Climax, 8:11854 (R;US)
Experimental design and data analysis, 8:13536 (R;US)
Explosive consolidation of aluminum nitride ceramic powder: a case history, 8:12716 (R;US)
Extension of the Smith predictor, 8:12793 (R;US)
Fluid-structure-coupling algorithm, 8:12420 (R;US)
Fuel-cell technology assessment. Volume I. The potential value of US fuel-cell technology in foreign countries, 8:12526 (R;US)
Fuel-cell technology assessment. Volume II. Evaluation of Japan, 8:12527 (R;US)
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Fuel-cell technology assessment. Volume V. Evaluation of South Korea, 8:12530 (R;US)
Gaussian-profile beams, 8:12908 (R;US)
Health physics instruments: what are the current needs, 8:12994 (R;US)
Joint research and development on toxic-material emergency response between ENEA and LLNL. 1982 progress report, 8:13196 (R;US)
Leadership opportunities in the new age, 8:13099 (R;US)
LINCS: Livermore's network architecture, 8:13568 (R;US)
Low-energy-positron production at the Livermore linac, 8:12934 (R;US)
Measurement of thermal diffusivity of rocks at high pressure, 8:13221 (R;US)
Microstructural modification of aluminum-silicon alloy powders during dynamic consolidation, 8:12691 (R;US)
Mirror advanced reactor study (MARS), 8:13468 (R;US)
NLTSS/LINCS for a presentation to Nuclear Software Systems Division, 8:13567 (R;US)
On-line liquid-effluent monitoring of sewage at Lawrence Livermore National Laboratory, 8:13092 (R;US)
PBX-9407 mechanical properties, 8:13012 (R;US)
Radioactive ions beams for studying astrophysical nuclear reactions, 8:12909 (R;US)
Resonantly-pumped soft-x-ray lasers using ICF drivers, 8:13497 (R;US)
Rheology via nonequilibrium molecular dynamics, 8:13409 (R;US)
Rotary flux compressor: a new high-power compact energy store, 8:12448 (R;US)
Summary of measurements and calculations of neutron and gamma-ray emission spectra from spheres pulsed with 14-MeV neutrons, 8:13378 (R;US)
Tests of cryogenic pigs for use in liquefied gas pipelines, 8:11821 (R;US)
Timing and control monitor system requirements: an overview, 8:13015 (R;US)
UNSPEC reference manual: 10/29/82 version, 8:13379 (R;US)
Wafer-scale laser lithography. I. Pyrolytic deposition of metal microstructures, 8:12887 (R;US)
ZAPP: Z-pinch atomic physics program, 8:13452 (R;US)

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Adiabatic compression of elongated field-reversed configurations, 8:13442 (R;US)
ALECS: assembly language extensions and control structures, 8:13551 (R;US)
Antares facility for inertial-fusion experiments: status and plans, 8:13485 (R;US)
Applying the MRV11-C board, 8:13552 (R;US)
Bismuth germanate as a high-energy gamma-ray detector, 8:12971 (R;US)
Buckling investigation of ring-stiffened cylindrical shells under unsymmetrical axial loads, 8:12352 (R;US)
Capabilities of the Los Alamos National Laboratory's environmental emergency-response vehicle, 8:13042 (R;US)
Coherent states with classical motion: from an analytic method complementary to group theory, 8:13407 (R;US)
Computer-controlled data communications test center, 8:13550 (R;US)
Conceptual designs for 100-MW space radiators, 8:12322 (R;US)
Consideration of a measurement of absolute value eta $_{\infty}$ ^{2}/ absolute value eta/sub +-/^{2} at LAMPF II, 8:13264 (R;US)
Current results from the Los Alamos CTX spheromak, 8:13438 (R;US)

Direct spectrum-analysis method for obtaining the relaxation-time spectrum from relaxation-response data: amorphous metals, 8:12684 (R;US)
Dispersion properties of spiral deflecting systems, 8:12890 (TG;US)
Diurnal variability of wind velocity increase with height, 8:13022 (R;US)
Drive for the hf quadrupole structure, 8:12898 (TG;US)
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R;US)
Fast correlation method for passive-solar design, 8:12161 (R;US)
Flow cytometric quantification of radiation responses of murine peritoneal cells, 8:13152 (R;US)
FRC confinement studies in FRX-C, 8:13441 (R;US)
Gamma bursts, 8:13231 (R;US)
Gamma rays from the interactions of reactor fast neutrons ordered by increasing gamma-ray energy, 8:13334 (R;US)
High-brightness negative-hydrogen linear accelerator, 8:12906 (R;US)
Inductive-wall and longitudinal space-charge impedances in LAMPF II, 8:12905 (R;US)
Inventory-sample coincidence-counter manual, 8:11939 (R;US)
LAMAP, the Los Alamos National Laboratory mapping code, 8:13554 (R;US)
LENS* 4: a program for calculation of geometric optics of the human eye, 8:13136 (R;US)
Levelized life-cycle costs for four residue-collection systems and four gas-production systems, 8:12063 (R;US)
Linac technology for free-electron lasers, 8:12865 (R;US)
Los Alamos hot-dry-rock project: recent results, 8:12245 (R;US)
Los Alamos National Laboratory building cost index, 8:12850 (R;US)
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Measurements and modeling of gamma absorbed doses due to releases from a linear proton accelerator: experimental design and preliminary results, 8:13043 (R;US)
Non-LTE astrophysics and the origin of high-energy cosmic rays, 8:13230 (R;US)
Origin of a sanidine-coesite grospydite, 8:13218 (R;US)
Plutonium roundtable discussion, 8:12824 (R;US)
Preliminary economic assessment or residential passive solar cooling potential in the United States, 8:12160 (R;US)
Quality assurance for environmental analytical chemistry at Los Alamos, 8:13028 (R;US)
Simple EOS for branched (low-density) polyethylene, 8:12723 (R;US)
Simple EOS for linear (high-density) polyethylene (Marlex), 8:12724 (R;US)
SLR methods for attached sunspaces, 8:12162 (R;US)
Spectroscopic studies of impurity control in coaxial sources for spheromaks at Los Alamos, 8:13437 (R;US)
Spheromak ICRF heating studies at low power, 8:13439 (R;US)
Study of certain plane spiral deflecting systems of traveling-wave tubes, 8:12889 (TG;US)
Subsurface subsidence damage monitoring: acoustic tomography and microgravimetry, 8:13060 (R;US)
Supplementary documentation for an environmental impact statement regarding the Pantex Plant: hydrologic study for the Iowa Army Ammunition Plant, 8:13074 (R;US)
Texas Panhandle soil-crop-beef food chain for uranium: a dynamic model validated by experimental data, 8:13065 (R;US)
Unique aspects of drilling and completing hot-dry-rock geothermal wells, 8:12246 (R;US)
VAXMATH: a mathematical software library for the VAX, 8:13553 (R;US)
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Isotopic separation device on-line with a heavy ion accelerator, 8:12926 (R;FR;In French)

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Reproducibility of the Langlie Technique for establishing probabilities of LX-10 skid initiation, 8:13010 (R;US)

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Role of radiation on the power balance of the Alcator C tokamak, 8:13423 (R;US)

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Photovoltaic-array/power-conditioner interface, 8:12109 (R;US)
Power processing subsystems for the 100-kWp solar-photovoltaic-power system at the Natural Bridges National Monument in Utah, 8:12110 (R;US)
Massachusetts Univ., Amherst (USA)
Conversion of cellulose to ethanol by mesophilic bacteria. Progress report and third year budget, 8:11971 (R;US)
Maurer Engineering, Inc., Houston, TX (USA)
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Pelletized waste form demonstration program, April-September 1982, 8:11890 (R;US)
Selected measurement data for plutonium and uranium, 8:11940 (R;US)
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Worldwide market for photovoltaics in the rural sector, 8:12015 (R;US)
National Audubon Society, New York (USA). Research Dept.
Florida atlas of breeding sites for herons and their allies: 1976-1978, 8:13055 (R;US)
National Bureau of Standards, Washington, DC (USA)
Measurement techniques for high-power semiconductor materials and devices. Annual report, October 1, 1980-December 31, 1981, 8:12885 (R;US)

National Center for Analysis of Energy Systems, Upton, NY (USA)
Comparing the health and environmental hazards of different energy systems, 8:13100 (R;US)
National Center for Resource Recovery, Inc., Washington, DC (USA)
Prototype tramp-metal separator: a summary of test results, 8:12633 (R;US)
National Fertilizer Development Center, Muscle Shoals, AL (USA)
Particle-size requirements for bulk blend materials. Circular Z-146, 8:12746 (R;US)
Situation 82. Bulletin Y-174, 8:13139 (R;US)
National Radiological Protection Board, Harwell (UK)
Mini-instruments environmental monitor Type 5.10G. Instrument evaluation no. 21, 8:12975 (R;GB)
National Regulatory Research Inst., Columbus, OH (USA)
Funding nuclear-power-plant decommissioning. Final report, 8:12336 (R;US)
National Research Council, Washington, DC (USA). Committee on Magnetic Fusion
Future engineering needs of magnetic fusion, 8:13473 (R;US)
Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)
Design characteristics of a cyclotron for producing radioisotopes, 8:12827 (TG;DE;GE)
Determination of energetic parameters of the beam of the EhGP-10-P charge-exchange electrostatic accelerator, 8:12928 (R;SU;In Russian)
Naval Civil Engineering Lab., Port Hueneme, CA (USA)
Operating and maintenance experience with a 6-kW wind energy conversion system at Naval Station, Treasure Island, California. Technical note Sep 79-Jun 81, 8:12261 (R;US)
Naval Coastal Systems Center, Panama City, FL (USA)
Calibration of sonic flowmeters for Ocean Thermal Energy Conversion (OTEC), 8:12131 (R;US)
Heat exchanger cleaning in support of ocean thermal energy conversion (OTEC) - electronics subsystems, 8:12129 (R;US)
Heat exchanger cleaning in support of ocean thermal energy conversion (OTEC) - mechanical subsystem, 8:12130 (R;US)
Naval Research Lab., Washington, DC (USA)
Numerical study of phase conjugation in stimulated Brillouin scattering from an optical waveguide, 8:13488 (R;US)
Stability and symmetry in inertial-confinement fusion, 8:13487 (R;US)
Naval Surface Weapons Center, Silver Spring, MD (USA)
Development of improved separators for alkaline zinc batteries. Final report, 8:12455 (R;US)
Nebraska Alcohol Fuels Corp., Lincoln (USA)
Feasibility study for alternative-fuels production in Lincoln, Nebraska, 8:12055 (R;US)
Newcomb and Boyd Consulting Engineers, Atlanta, GA (USA)
Controlling energy consumption in single buildings. Final report for period ending May 82, 8:12551 (R;US)
New Mexico Highlands Univ., Las Vegas (USA)
Texas Panhandle soil-crop-beef food chain for uranium: a dynamic model validated by experimental data, 8:13065 (R;US)
New Mexico Univ., Albuquerque (USA). Dept. of Economics
Preliminary economic assessment or residential passive solar cooling potential in the United States, 8:12160 (R;US)
New York Univ., NY (USA). Courant Inst. of Mathematical Sciences
On a class of high resolution total-variation-stable finite-difference schemes, 8:13413 (R;US)
New York Univ., NY (USA). Dept. of Environmental Medicine
Oncogenic action of ionizing radiation on rat skin. Comprehensive progress report, February 1, 1980-January 31, 1983, 8:13141 (R;US)
North American Electric Reliability Council, Princeton, NJ (USA)
Generating capacity in US electric utilities: how is it used; how much is needed over the decade, 8:12505 (R;US)
North Carolina State Univ., Raleigh (USA). Dept. of Mechanical and Aerospace Engineering
First year's performance data of the NCSU Solar Energy and Conservation House, 8:12134 (R;US)
North Carolina Univ., Chapel Hill (USA)
Progress report, September 1, 1981-August 31, 1982, 8:13294 (R;US)
North Carolina Univ., Chapel Hill (USA). Dept. of Physics
Application of the electron-cyclotron resonance source to Lamb-shift polarized ion sources, 8:13235 (R;US)
North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy
Energy calibration of the TUNL dual-90° magnet analyzing system, 8:12915 (R;US)
Theory of Coulomb excitation and ionization, 8:13236 (R;US)
North Dakota Univ., Grand Forks (USA). Engineering Experiment Station
Evaluation of hydrothermal resources of North Dakota. Phase III final technical report, 8:12198 (R;US)
Northeastern Univ., Boston, MA (USA). Dept. of Physics
Physics with the MAC detector, 8:12940 (R;US)
Northern Energy Corp., Boston, MA (USA)
Co-utilization of municipal solid waste and wood residues for small-scale resource recovery: a preliminary assessment, 8:12637 (R;US)
Northern Illinois Univ., Dekalb (USA)
Measurement of nu/sub e/ and anti nu/sub e/ elastic scattering as a test of the standard model, 8:13253 (R;US)
Northwestern Univ., Evanston, IL (USA). Technological Inst.
LOCA hydroloads calculations with multidimensional nonlinear fluid/structure interaction. Volume 3. Fluid/structure interaction studies using 3-D STEALTH/WHAMSE. Final report, 8:12390 (R;US)
Nuclear Regulatory Commission, King of Prussia, PA (USA). Region I
NRC TLD direct radiation monitoring network. Progress report, April-June 1982, 8:12367 (R;US)
Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control
Nuclear Regulatory Commission Issuances, 8:12329 (R;US)
Title list of documents made publicly available, August 1-31, 1982, 8:12328 (R;US)
Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data
Power reactor events, 8:12409 (R;US)
Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation
Intergrated plant safety assessment. Systematic evaluation program. Palisades plant, Consumers Power Company, Docket No. 50-255. Final report, 8:12407 (R;US)
Safety evaluation report related to the operation of WPPSS Nuclear Project No. 2, Docket No. 50-397, Washington Public Power Supply System, 8:12331 (R;US)
Safety evaluation report related to the operation of Sequoyah Nuclear Plant, Units 1 and 2, Docket Nos. 50-327 and 50-328, Tennessee Valley Authority, 8:12404 (R;US)
Safety evaluation report related to the renewal of the operating license for the Worcester Polytechnic Institute open-pool training reactor, Docket No. 50-134, 8:12408 (R;US)
Supplement to Final Environmental Statement related to construction and operation of Clinch River Breeder Reactor Plant, Docket No. 50-537, 8:12366 (R;US)
Suppression-pool temperature limits for BWR containments, 8:12406 (R;US)
Technical specifications: San Onofre Nuclear Generating Station, Unit No. 3, Docket No. 50-362. Appendix A to license No. NPF-15, 8:12308 (R;US)
Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management
Summary information report, 8:12330 (R;US)
Unresolved safety issues summary: aqua book, 8:12405 (R;US)
NWT Corp., San Jose, CA (USA)
Secondary water chemistry control at St. Lucie No. 1, 8:12307 (R;US)

O

Oak Ridge Associated Universities, Inc., TN (USA)
Human factors in Remote-Control-Engineering Task development activities. Consolidated Fuel-Reprocessing Program, 8:11820 (R;US)
Nuclear-fuel-cycle costs. Consolidated Fuel-Reprocessing Program, 8:11847 (R;US)
Supplemental stack-effluent monitoring at the Safety Light Corporation, Bloomsburg, Pennsylvania. Final report, 8:13037 (R;US)

Training farmworkers for industrial jobs: a longitudinal study, 8:12466 (R;US)
Oak Ridge Associated Universities, Inc., TN (USA). Manpower Education, Research and Training Div.
Assessment of benefit-cost analysis for coal-extraction R and D, 8:11738 (R;US)
Oak Ridge Gaseous Diffusion Plant, TN (USA)
Environmental assessment of the Oak Ridge Gaseous Diffusion Plant site, 8:11921 (R;US)
Hydrochemical and stream sediment detailed geochemical survey for Kettle Falls and Midnite Mine Areas, Washington, 8:11837 (R;US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Phoenix quadrangle, Arizona. Uranium Resource Evaluation Project, 8:11830 (R;US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Fresno and Death Valley quadrangles, California; Nevada. Uranium Resource Evaluation Project, 8:11832 (R;US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Adel, Jordan Valley, and Twin Falls quadrangles, Oregon; Idaho. Uranium Resource Evaluation Project, 8:11834 (R;US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Idaho Falls quadrangle, Idaho. Uranium Resource Evaluation Project, 8:11836 (R;US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R;US)
Oak Ridge National Lab., TN (USA)
Advanced servomanipulator performance summary. Consolidated Fuel-Reprocessing Program, 8:12843 (R;US)
Applicability of earth coupled heat pumps and factors affecting their performance, 8:12557 (R;US)
Applications of energy release rate techniques to part-through cracks in plates and cylinders. Volume 1. ORMGEN-3D: a finite element mesh generator for 3-dimensional crack geometries, 8:12353 (R;US)
Bird communities and vegetation structure in pine plantations of the southeastern Coastal Plain, 8:13052 (R;US)
BWR 4/Mark I accident sequences assessment, 8:12415 (R;US)
Cloud water: an important vector of atmospheric deposition, 8:13020 (R;US)
Coal slurry mixing: residence time and temperature effects on SRC feed slurries, 8:11655 (R;US)
Communications interface for the PDP-11 and the Nuclear Data 6600, 8:13444 (R;US)
Condensation of Refrigerant-11 on the outside of horizontal and inclined enhanced tubes, 8:12241 (R;US)
Consolidated Fuel-Reprocessing Program. ASM mechanical system, 8:12841 (R;US)
Consolidated Fuel-Reprocessing Program. Servomanipulator control systems, 8:12840 (R;US)
Database automation of accelerator operation, 8:12930 (R;US)
Design concept for the FED poloidal field coils using an internally cooled cable superconductor, 8:13491 (R;US)
Determination of local heat transfer during falling-film evaporation and condensation on fluted surfaces for the purpose of designing high-efficiency evaporators, 8:12875 (TG;US)
Documentation of the Resource Allocation and Mine-Costing (RAMC) model, 8:11783 (R;US)
Double Regge exchange in rho $\Delta\pi$ and rho rho N final states from π^-p interactions at 8 GeV/c, 8:13257 (R;US)
Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance, 8:11867 (R;US)
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R;US)
Evaluation of a heat exchanger for use in the Integrated Equipment Test facility solvent-extraction system, 8:11848 (R;US)
Evaluation of events involving service water systems in nuclear power plants, 8:12295 (R;US)
FECWASTE: user's manual of a Finite-Element Code for simulating WASTE transport through saturated-unsaturated porous media. Environmental Sciences Division Publication No. 1907, 8:11926 (R;US)
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R;US)
Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982, 8:12294 (R;US)
Industry-standard manipulator integrated maintenance system. Consolidated Fuel-Reprocessing Program, 8:12842 (R;US)
Initial wall conditioning in Doublet III, 8:13479 (R;US)
In-situ study of attic loose-fill thermal insulation in residential application, 8:12558 (R;US)
Introduction to modeling fish migratory behavior, 8:13102 (R;US)
Investigation of the effect of the uranyl ion on proton-spin-relaxation times in aqueous solutions, 8:13007 (R;US)
Laboratory evaluation of the heating capacity and efficiency of a high-efficiency, air-to-air heat pump with emphasis on frosting/defrosting operation, 8:12563 (R;US)
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R;US)
Measured effect of forced ventilation on house infiltration rate, 8:12559 (R;US)
Methods of removing uranium from drinking water. I. A literature survey. II. Present municipal water treatment and potential removal methods, 8:13084 (R;US)
Model of naticid gastropod predator-prey coevolution, 8:13073 (R;US)
Multicomponent separations using a continuous annular chromatograph, 8:12759 (R;US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R;US)
ND6600 computer in fusion-energy research, 8:13445 (R;US)
New technologies in fossil-fuel utilization, 8:12491 (R;US)
Nuclear medicine progress report for quarter ending September 30, 1982, 8:13131 (R;US)
Nuclear-fuel-cycle costs. Consolidated Fuel-Reprocessing Program, 8:11847 (R;US)
On-farm use of biomass fuels: market penetration potential during normal and fuel-emergency conditions, 8:12065 (R;US)
Options for electricity use and management during a petroleum shortage, 8:12508 (R;US)
ORNL neutral-beam program in 1978, 8:13490 (R;US)
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R;US)
Radioisotope-powered light sources, 8:11946 (R;US)
Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R;US)
Regional assessment of potential sensitivity of soils in the eastern United States to acid precipitation, 8:13062 (R;US)
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R;US)
Remote-Systems Demonstration Facility. Consolidated Fuel-Reprocessing Program, 8:12839 (R;US)
Scoping design analyses for optimized shipping casks containing 1-, 2-, 3-, 5-, 7-, or 10-year-old PWR spent fuel, 8:12855 (R;US)
Servomotor test stand. Consolidated Fuel-Reprocessing Program, 8:12844 (R;US)
Short-Rotation Woody-Crops Program. Annual progress report for 1981, 8:12066 (R;US)
Short-tube refrigerant-flow restrictors, 8:12556 (R;US)
Streaming of 14-MeV neutrons through an iron duct: comparison of measured neutron and gamma-ray energy spectra with results calculated using the Monte Carlo code MCNP, 8:13492 (R;US)
Strontium leachability of hydrofracture grouts for sludge-slurries, 8:11866 (R;US)
Study of heat and mass transfer in a vertical-tube evaporative cooler, 8:12614 (R;US)
Study of hydraulic air compression for Ocean Thermal Energy Conversion open-cycle application, 8:12132 (R;US)
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R;US)
Technical considerations in choosing alcohol fuels for less-developed countries, 8:12041 (R;US)
Techno-economic assessment on the utilization of surge-leg pumps in coal liquefaction, 8:11654 (R;US)
Theoretical relationships between creep and swelling by point defect absorption during irradiation, 8:12660 (R;US)
Three equipment concepts for the Fusion Engineering Device, 8:13465 (R;US)
Tracer theory with applications in geosciences. Environmental Sciences Division, Publication No. 1964, 8:13197 (R;US)

Two-phase, two-component Stirling engine with controlled evaporation, 8:12648 (R;US)
Ultrasonic examination of JBK-75 strip material, 8:13493 (R;US)
Oak Ridge Y-12 Plant, TN (USA)
Control-systems improvements in a precision coordinate measuring machine, 8:12857 (R;US)
Improving divider calibration techniques, 8:12888 (R;US)
Laser-interferometer position-feedback for precision machine tools, 8:13499 (R;US)
Regrinding and relapping of single-point, single-crystal diamond turning and boring tools, 8:12856 (R;US)
Revision of the eutectoid isotherms of the uranium-chromium system, 8:12692 (R;US)
Technical considerations in choosing alcohol fuels for less-developed countries, 8:12041 (R;US)
Oesterreichischer Verband fuer Strahlenschutz (OeVS), Vienna. Studiengruppe fuer Radioaktivitaetsmessungen im Donauraum (OeSRAD)
Environmental radioactivity in the Austrian section of the river Danube (1975-1979). Natural radioactivity and radiation in Austria. Proceedings of the 5. and 6. annual meeting of the OeSRAD, 8:13087 (R;AT;GE)
Ohio River Basin Energy Study, Urbana, IL (USA)
Ohio River Basin energy study: health aspects, 8:12284 (R;US)
Ohio State Univ., Columbus (USA). Dept. of Chemical Engineering
Analysis of gas purification by heatless adsorption, 8:12748 (R;US)
Ohio State Univ., Columbus (USA). Dept. of Physics
Neutrino mixing in grand unified models, 8:13271 (R;US)
Ontario Hydro, Toronto (Canada)
Comparison of Ontario Hydro's performance with world power reactors, 1981, 8:12475 (R;CA)
Ontario Ministry of Energy, Toronto (Canada)
Notes for an address on coal, 8:11787 (R;CA)
Opportunity Systems, Inc., Washington, DC (USA)
State of California: resource-recovery profile, 8:12634 (R;US)
Oregon State Univ., Corvallis (USA)
Subsurface subsidence damage monitoring: acoustic tomography and microgravimetry, 8:13060 (R;US)
Oregon State Univ., Corvallis (USA). Dept. of Electrical and Computer Engineering
Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R;US)
Oregon State Univ., Corvallis (USA). School of Oceanography
Increase of total CO_2 in the world oceans. Annual progress report, 8:13081 (R;US)
Observations of volcanic tremor at Mt. St. Helens volcano, 8:13206 (R;US)
Oregon Univ., Eugene (USA)
Laser spectroscopy of combustion intermediates, 8:12829 (R;US)
Osaka Univ., Suita (Japan). Research Center for Nuclear Physics
$^{27}Al(p,\gamma)^{28}Si$ and $^{27}Al(^3He,d)^{28}Si$ to the stretched 11.58-MeV (6^-,0) and 14.36-MeV (6^-,1) levels, 8:13316 (R;US)
Osaka Univ., Toyonaka (Japan). Dept. of Physics
$^{27}Al(p,\gamma)^{28}Si$ and $^{27}Al(^3He,d)^{28}Si$ to the stretched 11.58-MeV (6^-,0) and 14.36-MeV (6^-,1) levels, 8:13316 (R;US)
Owens-Illinois, Inc., Toledo, OH (USA)
Evaluation of solar selective coating stability. Final report, September 1, 1978-May 31, 1980, 8:12178 (R;US)
Evaluation of SUNPACK tube vacuum quality. Final report, 1 September 1978-31 May 1980, 8:12177 (R;US)

P

Pacific Gas and Electric Co., San Francisco, CA (USA)
Development of the utilization of combustible gas produced in existing sanitary landfills: investigation of effects of air inclusion, 8:12630 (R;US)
Pacific Northwest Lab., Richland, WA (USA)
1976 Hanford Americium exposure incident: hematologic effects, 8:13149 (R;US)
1976 Hanford americium exposure incident: in vivo measurements, 8:13147 (R;US)
1976 Hanford americium exposure incident: organ burden and radiation dose estimates, 8:13148 (R;US)
1976 Hanford americium exposure incident: overview and perspective, 8:13142 (R;US)
1976 Hanford americium-exposure incident: decontamination and treatment facility, 8:13146 (R;US)
1976 Hanford americium-exposure incident: external decontamination procedures, 8:13145 (R;US)
1976 Hanford americium-exposure incident: histologic and autoradiographic observations on skin, 8:13150 (R;US)
1976 Hanford americium-exposure incident: urinary excretion of trace metals during DTPA treatments, 8:13151 (R;US)
Accident-generated aerosols: assessment methodology, 8:13031 (R;US)
Acoustic-emission linear-pulse holography, 8:12881 (R;US)
Barriers to household investment in residential energy conservation: preliminary assessment, 8:12566 (R;US)
Biological effects of high-strength electric fields on small laboratory animals. Interim report, March 1, 1978-September 30, 1979, 8:13194 (R;US)
Characteristics of airborne plutonium resuspended from near-background aged surface-sources, 8:13047 (R;US)
Comprehensive (MORT based) approach to planning internal decontamination, 8:12418 (R;US)
Consolidation theory and its applicability to the dewatering and covering of uranium-mill tailings, 8:11924 (R;US)
Contaminant migration and fate research at Pacific Northwest Laboratory, 8:13045 (R;US)
Development of improved technology for decommissioning operations, 8:11903 (R;US)
Effect of using time-averaged precipitation for wet removal in a Lagrangian assessment model, 8:13030 (R;US)
Eighth DOE workshop on personnel neutron dosimetry, 8:13393 (R;US)
Estimating tail probabilities, 8:13408 (R;US)
Evaluation of experiences in long-term radon and radon-daughter measurements, 8:13044 (R;US)
Feasibility of vitrifying EPICOR II organic resins, 8:12394 (R;US)
Handbook for the design, selection, and construction of a rock cover for retired uranium-mill tailings, 8:11902 (R;US)
Interpretations of the OSCAR data for reactive-gas scavenging, 8:13024 (R;US)
Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments, 8:12687 (R;US)
Investigation of gasification of biomass in the presence of catalysts, 8:12067 (R;US)
Issues in federal preemption of state appliance energy-efficiency regulations, 8:12565 (R;US)
LOCA simulation in NRU program. Data report for thermal-hydraulic experiment 2 (TH-2), 8:12411 (R;US)
Loss detection and alarm resolution in processing special nuclear material, 8:11941 (R;US)
Mathematical simulation of sediment and radionuclide transport in estuaries, 8:13089 (R;US)
Measurements to determine the solubility of uranium yellowcake materials in the lungs of millworkers following acute exposure, 8:13156 (R;US)
Microdosimetry of 0.5 to 2.0 MeV electron beams, 8:13392 (R;US)
Multidimensional simulation of radon diffusion through earthen covers, 8:11922 (R;US)
Nuclear-waste management semiannual progress report, April 1982-September 1982, 8:11899 (R;US)
Overcoming barriers to residential conservation: do energy audits help, 8:12567 (R;US)
Overview of the Monitored Retrievable Storage (MRS) program, 8:11904 (R;US)
Perturbation method for stochastic operator difference equations, 8:13558 (R;US)
Potential role of biotic transport models in low-level-waste management, 8:11901 (R;US)
Proceedings of the 14th biomass thermochemical conversion contractor's meeting, 8:12068 (R;US)
Pumped-storage hydroelectric plants with underground lower reservoirs, 8:12450 (R;US)
Recycle of iodine-loaded silver mordenite by hydrogen reduction, 8:11900 (R;US)

Sediment and radionuclide transport in rivers: radionuclide transport modeling for Cattaraugus and Buttermilk Creeks, New York, 8:13090 (R;US)
Simple nocturnal slope-flow data from the Rattlesnake Mountain site, 8:13023 (R;US)
Survey of HEPA filter experience, 8:13046 (R;US)
Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents, 8:12413 (R;US)
Use of analytical electron microscopy and auger electron spectroscopy for evaluating materials, 8:12760 (R;US)
Use of color and motion for the display of multi-dimensional data, 8:13559 (R;US)

Paris-6 Univ., 75 (France). Inst. de Biologie Physico-Chimique
Investigation of electron-transport mechanisms in photosynthesis. Final report, 8:13127 (R;XE)

Paris-11 Univ., 91 - Orsay (France)
Study of the antivsub(μ)p interactions with a liquid hydrogen sensitive target surrounded with a Ne-H_2 mixture, 8:13261 (R;FR;In French)
Synthesis and simulation of corrector filter used for local measurement in PWR core from gamma thermometer signal, 8:12300 (R;FR;In French)
Tools for developing software for different types of microprocessors, to be used, in particular, for the acquisition and processing of nuclear data, 8:13542 (R;FR;In French)

Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire
Optical properties of the "Montpellier" spectrometer deduced from magnetic field measurement, 8:12968 (R;FR;In French)
Parallel plate detectors, 8:12969 (R;FR;In French)

Peill (J.E.), Canning, Nova Scotia (Canada)
Evaluation of a system utilizing biomass (straw) as fuel for crop drying and heating on the farm, 8:12064 (R;CA)

Pennsylvania State Univ., University Park (USA)
Integral transport multiregion geometrical shadowing factor for the approximate collision probability matrix calculation of infinite closely packed lattices, 8:12347 (D;US)
Iterative solution to the optimal control of depletion problem in pressurized water reactors, 8:12310 (D;US)

Pennsylvania State Univ., University Park (USA). Applied Research Lab.
Discrete frequency noise and its reduction in small axial-flow fans. Technical memo, 8:12836 (R;US)

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Perkins and Will, New York (USA)
Assessment of energy conservation opportunities in state-assisted housing, 8:12478 (R;US)

Pittsburgh Univ., PA (USA)
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R;US)
Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982, 8:11638 (R;US)

Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering
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H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R;US)
Supercritical fluids for extraction and reaction of coal and heavy oils. First quarterly progress report, September 1, 1982-December 1, 1982, 8:11633 (R;US)

Plett (Robert) Associates Ltd., Arlington, VA (USA)
Analytical history of the entitlements program, 8:11811 (R;US)
Analytical history of the entitlements program. Entitlement notices, November 1974-December 1977, 8:11812 (R;US)
Analytical history of the entitlements program: entitlement notices, January 1978-December 1980, 8:11813 (R;US)

Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Dept. de Engenharia Mecanica
Effect of tube plugging in the thermalhydraulic performance of 'U' tube steam generators, 8:12309 (R;BR;In Portuguese)
Measurements of peripherical static pressure and pressure drop in a rod bundle with helical wire wrap spacers, 8:12316 (R;BR;In Portuguese)
Semi-empirical model for the calculation of flow friction factors in wire-wrapped rod bundles, 8:12317 (R;BR;In Portuguese)
State of art of the methods for thermohydraulics design of LMFBR fuel elements, 8:12318 (R;BR;In Portuguese)

Pontificia Univ. Catolica do Rio de Janeiro (Brazil). Inst. de Fisica
Uranium content of petroleum by fission track technique, 8:12761 (R;BR)

Princeton Univ., NJ (USA)
Nuclear chemistry project. Progress report, April 1, 1982-March 31, 1983, 8:13349 (R;US)

Princeton Univ., NJ (USA). Dept. of Statistics
Least absolute deviations regression, 8:13414 (R;US)

Princeton Univ., NJ (USA). Plasma Physics Lab.
Alpha-particle simulation and diagnostics using $_3He^{++}$ minority ICRF heating, 8:13450 (R;US)
Diagnostics for neutral-beam-heated tokamaks, 8:13446 (R;US)
Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium, 8:13495 (R;US)
High-beta experiments with neutral-beam injection on PDX, 8:13449 (R;US)
Nuclear diagnostic for fast alpha particles, 8:13448 (R;US)
Radio-frequency wave trajectories for current drive in tokamak reactors, 8:13447 (R;US)

Public Service Co. of Colorado, Denver (USA)
Baghouse performance and ash characterization at the Arapahoe Power Station, 8:12281 (R;US)

Public Service Co. of Indiana, Inc., Plainfield (USA)
Compressed-air energy storage preliminary design and site-development program in an aquifer. Volume 4. Aquifer geology. Final report, 8:12449 (R;US)

Purdue Univ., Lafayette, IN (USA)
Extended burnup fuel cycle optimization for pressurized water reactors, 8:12311 (D;US)
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Stress analysis for nuclear power plant components, 8:12355 (R;BR)
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Engineering model for predicting rubble motion during blasting, 8:13220 (R;US)
Evaluation and control of conservatism in drop-table shock tests, 8:12883 (R;US)
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Non-recursive lowpass digital-filter algorithm, 8:13560 (R;US)
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Pressure-shear loading techniques for material-property studies, 8:12882 (R;US)
Quality assurance program for isotopic power systems, 8:12518 (R;US)
Quantitative fault tree analysis using the Set Evaluation Program (SEP), 8:13557 (R;US)
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Sandia nuclear microprobe, 8:12931 (R;US)
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Electrochemistry applied to thermal conversion, 8:12092 (R;US)
Engineering analysis of potential photosynthetic bacterial hydrogen-production systems, 8:11956 (R;US)
Homeowners survey: gas utilities and the residential solar market, 8:12640 (R;US)
Role of porphyrins and chlorophylls in artificial photosynthesis, 8:12816 (R;US)
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I/O register to FASTBUS interface, 8:13564 (R;US)
Measurement of the tau lifetime, 8:13266 (R;US)
Recent results from the MAC and MARK II detectors at PEP, 8:12932 (R;US)
SLAC Camac Crate Controller Model 3 (Engineering Materials), 8:13003 (E;US)
SLAC Mark II Detector (Engineering Materials), 8:13002 (E;US)
SLAC Touch Panel Model 4 (Engineering Materials), 8:12936 (E;US)

Software for managing multicrate FASTBUS Systems, 8:13565 (R;US)
Testing quantum chromodynamics, 8:13290 (R;US)
Use of nitrogen laser for observation of space-charge effects in drift chambers, 8:12992 (R;US)
Vacuum pipe for $e^+ e^-$ interactions, 8:12933 (R;US)
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TEXT energy-storage system, 8:13464 (R;US)

Texas Univ., Austin (USA). Center for Energy Studies
Community-Level Impacts Projection System (CLIPS). Final report, 8:12462 (R;US)
Groundwater-source heat-pump design development: consideration of locally variable factors. Final report, 8:12580 (R;US)
Incidence and effects of a windfall profit tax on natural gas, 8:11819 (R;US)

Texas Univ., Austin (USA). Dept. of Chemical Engineering
Solvent and chemical-reaction effects in supercritical extraction of coal. Fifth quarterly technical progress report, September 1-November 30, 1982, 8:11636 (R;US)

Texas Univ., Austin (USA). Dept. of Physics
Nuclear-structure studies using the high-resolution spectrometer at the Los Alamos Clinton P. Anderson Meson Physics Facility. Progress report, 8:13295 (R;US)

Texas Univ., Austin (USA). Fusion Research Center
Simplifying theorem for analyzing rf antennas with feeders, 8:13475 (R;US)

Texas Univ., Austin (USA). Lyndon Baines Johnson School of Public Affairs
Feasibility analysis of a regional energy-development bank. Final report, 8:12463 (R;US)

Texas Univ., Austin (USA). School of Architecture
Passive-solar homes for Texas, 8:12173 (R;US)

Texas Univ., El Paso (USA)
Demonstrate use of solar energy for laundromat washing and drying. Final report, 8:12171 (R;US)

Texas Univ., Galveston (USA). Medical Branch
Parametric statistical methods and sample-size considerations for dominant lethal experiments: the use of clustering to achieve approximate normality, 8:13179 (R;US)

Texas Univ., Houston (USA). Health Science Center
Exposure of pharmacy personnel to mutagenic antineoplastic drugs, 8:13130 (R;US)

Thermo Electron Corp., Waltham, MA (USA)
Preliminary investigations of thermionic converters utilizing HOTEMA and DFVLR electrodes, 8:12519 (R;US)

Timmerman Engineering Co., Inc., Phoenix, AZ (USA)
Corona del Sol High School solar system, Tempe Union High School District No. 213. Final technical report (Engineering Materials), 8:12174 (E;US)

Tohoku Univ., Sendai (Japan)
Double Regge exchange in rho $\Delta\pi$ and rho rho N final states from π^- p interactions at 8 GeV/c, 8:13257 (R;US)

Triangle Universities Nuclear Lab., Durham, NC (USA)
Energy calibration of the TUNL dual-90° magnet analyzing system, 8:12915 (R;US)

Trident Engineering Associates, Inc., Annapolis, MD (USA)
Assessment of groundwater usage at Chalk Point power plant. Final report, 8:12278 (R;US)

Trinity Univ., San Antonio, TX (USA)
Solar-regenerated desiccant dehumidification. Final report, 8:12170 (R;US)

TRW, Inc., Redondo Beach, CA (USA)
Gravimelt process development. Quarterly technical progress report, 8:11755 (R;US)

U

UKAEA Atomic Energy Research Establishment, Harwell. Materials Physics Div.
Evaluation of a computer aided X-ray fluorographic system: part 1 - system analysis, 8:12876 (R;GB)
UKAEA Authority Fuel Processing Directorate
Objectives for radioactive waste packaging, 8:11863 (R;GB)
UKAEA Risley Nuclear Power Development Establishment
Incidents in German nuclear power stations, 8:12447 (TG;GB)
In-pile fuel cycle of heterogeneous oxide fast reactors, 8:12321 (TG;GB)
UKAEA Risley Nuclear Power Development Establishment, Culcheth. Safety and Reliability Directorate
Survey of defects in pressure vessels in the UK for the period 1962-1978 and its relevance to nuclear primary circuits, 8:12354 (R;GB)
Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.
Hydrogeochemical and stream-sediment reconnaissance basic data for San Luis Obispo and Santa Cruz Quadrangles, California, 8:11831 (R;US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Caliente, Lund, Ely, and Elko Quadrangles, Nevada; Utah, 8:11833 (R;US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Hailey and Challis Quadrangles, Idaho, 8:11835 (R;US)
Three equipment concepts for the Fusion Engineering Device, 8:13465 (R;US)
Uranium enrichment, 8:12474 (R;US)
Union Carbide Corp., Tarrytown, NY (USA). Tarrytown Technical Center
Liquid-hydrocarbon fuels from syngas. First annual report, March 1981-February 1982, 8:11962 (R;US)
Liquid-hydrocarbon fuels from syngas. Quarterly report, March 1982-May 1982, 8:11963 (R;US)
Union Coll., Schenectady, NY (USA)
Effects of energy constraints on transportation systems: proceedings of the fifth national conference, 8:12582 (R;US)
United Coal Co., Bristol, VA (USA)
Project to develop and demonstrate methods to eliminate frozen-coal-handling problems. Final report, 8:11753 (R;US)
United Technologies Corp., South Windsor, CT (USA). Power Systems Div.
Conceptual integrated gasifier combined-cycle power-plant design. Final report, 8:11621 (R;US)
On-site fuel cell power plant technology development program. Annual report Jan 81-Dec 81, 8:12523 (R;US)
Preliminary design of an alternate high-temperature turbine. A topical report for Phase II of the High-Temperature-Turbine Technology Program, 8:12276 (R;US)
United Technologies Research Center, East Hartford, CT (USA)
Solar/gas Rankine/Rankine-cycle heat pump assessment. Final report Mar 81-Jul 82, 8:12164 (R;US)
Universidade Federal Fluminense, Niteroi (Brazil). Inst. de Fisica
Sensitivity of control times in function of core parameters and oscillations control in thermal nuclear systems, 8:12361 (R;BR;In Portuguese)
Universite Catholique de Louvain, Louvain-la-Neuve (Belgium)
Harmonizatoin of data banks from energy model EFOM 12C with other Belgian data banks. Final report, 8:12461 (R;XE;FR)
UOP/SDC, Joint Venture, McLean, VA (USA)
Fifth technical contractors' conference on peat, 8:11579 (R;US)
Second technical contractors' conference on peat, 8:11600 (R;US)
USDOE Assistant Secretary for Management and Administration, Washington, DC. Directorate of Procurement and Assistance Management
Types of Contracts and Agreements Guide (Part II): cost-plus-award-fee contracting, 8:13534 (R;US)
USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of the Executive Secretary
United States Department of Energy: a history, 8:12487 (R;US)
USDOE Assistant Secretary for Nuclear Energy, Washington, DC. Office of Converter Reactor Deployment
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R;US)
USDOE Economic Regulatory Administration, Washington, DC. Office of Fuels Programs
Final Northeast Regional Environmental Impact Statement: potential conversion of forty-two powerplants from oil to coal or alternate fuels, 8:12270 (R;US)
Utah Univ., Salt Lake City (USA). Dept. of Physics
Physics with the MAC detector, 8:12940 (R;US)

V

Vetter Research, Costa Mesa, CA (USA)
Acidification of geothermal wells: Laboratory experiments. Geothermal Reservoir Well-Stimulation program, 8:12243 (R;US)
Hydraulic fracture stimulation treatment of Well Baca 23. Geothermal Reservoir Well-Stimulation Program, 8:12242 (R;US)
Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)
Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, October 1-December 31, 1982, 8:11673 (R;US)
Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, July 1, 1982-September 30, 1982, 8:11632 (R;US)
Nonlinear diffusion theory model for xenon-induced flux oscillations, 8:12346 (D;US)
Residual strain and strength loss in filament wound circular rings. Final report, October 13, 1980-September 30, 1981, 8:12720 (R;US)
Virginia Univ., Charlottesville (USA)
Heat, mass, and momentum transfer from large two-phase bubbles, 8:12320 (D;US)
VTN Consolidated, Inc., Irvine, CA (USA)
Heber Known Geothermal Resources Area ethanol-fuel facility. Final technical report, 8:12056 (R;US)

W

Wapora, Inc., Chicago, IL (USA)
Phase I report: inventory of potential small-scale hydropower sites in Illinois and selection of projects exhibiting potential for development. Final report, 8:11994 (R;US)
Small scale hydropower development in Illinois: an implementation manual. Final report, 8:11993 (R;US)
Washington State Univ., Pullman (USA)
Nature and mechanism of induction of mutations. Annual progress report, October 1, 1981-August 1, 1982, 8:13103 (R;US)
Washington Univ., Seattle (USA)
^{7}Be decay scheme and the solar-neutrino problem, 8:13227 (R;US)
High-temperature integrated thermal-energy-storage system for solar-thermal applications. Final subcontract report, 8:12181 (R;US)
Oscillating neutrons and disappearing baryons: a theoretical overview, 8:13275 (R;US)
Washington Univ., Seattle (USA). Dept. of Genetics
Fermentation to ethanol of xylose present in biomass byproduct solution. Progress report, April 1-December 31, 1982, 8:12042 (R;US)
Washington Univ., Seattle (USA). Dept. of Physics
^{27}Al(p,γ)^{28}Si and ^{27}Al(^{3}He,d)^{28}Si to the stretched 11.58-MeV (6^-,0) and 14.36-MeV (6^-,1) levels, 8:13316 (R;US)
Experimental and theoretical nuclear physics. Final report, 8:13292 (R;US)
Parity-nonconserving nuclear forces, 8:13355 (R;US)
Summing logs: the saga continues....., 8:13288 (R;US)
Washington Univ., Seattle (USA). Nuclear Physics Lab.
Cosmic clocks, 8:13228 (R;US)
Isospin mixing in ^{24}Mg, 8:13315 (R;US)
Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R;US)

Washington Univ., Seattle (USA). School of Medicine
Marrow-tumor interactions: the role of the bone marrow in controlling chemically induced tumors. Annual progress report, August 1, 1981-July 31, 1982, 8:13118 (R;US)
Western Kentucky Univ., Bowling Green (USA). Dept. of Chemistry
New catalysts for coal-liquid upgrading. Quarterly report, September 1-December 31, 1982, 8:11637 (R;US)
Western Kentucky Univ., Bowling Green (USA). Ogden Coll. of Science, Technology and Health
Predictors of plasticity in bituminous coals. Technical progress report No. 5, 8:11672 (R;US)
Westinghouse Electric Corp., Mercury, NV (USA). Advanced Energy Systems Div.
Commercial nuclear waste research and development program. Annual report, fiscal year 1982, 8:11875 (R;US)
Commercial nuclear-waste research and development program. Quarterly report, July-September 1982, 8:11874 (R;US)
Westinghouse Electric Corp., Pittsburgh, PA (USA)
Doubly fed machine review: agenda. Conference report, Washington, DC, 8:12263 (R;US)
Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.
Low-cost solar-array project: cell and module formation research area. Process research of non-CZ silicon material. Quarterly report No. 3, September 1, November 30, 1982, 8:12050 (R;US)
Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center
Development and demonstration of an electric heat pump for waste-heat recovery in industry. The selection of working-fluid candidates for use in high-temperature industrial heat pumps. Topical report, September 1977-December 1978, 8:12620 (R;US)
Development and demonstration of an electric heat pump for waste-heat recovery in industry. Preliminary design report, 8:12621 (R;US)
Materials research for hydrogen-cooled superconducting power-transmission lines (SPTL). Part I. Liquid hydrogen as a dielectric. Part II. Superconducting materials. Annual report, January 1, 1981-December 31, 1981, 8:12668 (R;US)
Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Labs.
Seven technologies for the eighties, 8:12470 (R;US)
Westinghouse Hanford Co., Richland, WA (USA)
Hardening of irradiated alloys due to the simultaneous formation of vacancy and interstitial loops, 8:12661 (R;US)
Westinghouse Research and Development Center, Pittsburgh, PA (USA)
Gas characterization from fluidized-bed coal gasification. Fourth quarterly report, June 1-August 31, 1982, 8:11627 (R;US)
West Texas State Univ., Canyon (USA). Alternative Energy Inst.
Use of wind power to assist in stripper (oil) well pumping, 8:12265 (R;US)
Wind-assist irrigation and electrical-power generation. Final report, 8:12266 (R;US)
West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering
Studies on the regeneration of sulfided iron oxide sorbent with steam-air mixtures. Final technical report, 8:11626 (R;US)
White (E.H.) and Co., Inc., San Francisco, CA (USA)
Ecological characterization of the central and northern Californa coastal region. Volume IV. Watersheds and basins. Chapters 17-29, 8:13071 (R;US)
Wisconsin Legislative Council Staff, Madison (USA)
Acid rain: a background report, 8:13029 (R;US)
Wisconsin Univ., Madison (USA)
Fast breeder reactor on-line monitoring and diagnosis strategy development via Dynamic Data System (DDS) methodology, 8:12364 (D;US)
UW-4F: a mechanistic four-fluid two-phase flow model for LOCA analysis during reflood, 8:12442 (D;US)
Wisconsin Univ., Madison (USA). Dept. of Geology and Geophysics
Model of naticid gastropod predator-prey coevolution, 8:13073 (R;US)
Wisconsin Univ., Madison (USA). Dept. of Physics
Physics with the MAC detector, 8:12940 (R;US)
Wisconsin Univ., Madison (USA). Inst. for Environmental Studies
An assessment of wind characteristics and wind energy conversion systems for electric utilities, 8:12259 (R;US)
Woodward-Clyde Consultants, San Francisco, CA (USA)
Assessment of the effects of surficial geologic processes in the Pasco Basin, 8:11905 (R;US)
In situ and laboratory geotechnical test results from borehole GD-1 in southeast Utah, 8:11897 (R;US)
World Meteorological Organization, Geneva (Switzerland)
Energy and special applications programme, report No. 2 (1981). Papers presented at the WMO technical conference on meteorology and energy, 8:11999 (R;CH)
Wyoming Geological Survey, Laramie (USA)
Bibliography and index of Wyoming uranium through 1973. Bulletin 61, 8:11826 (R;US)
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R;US)
Wyoming's oil and gas industry. Public information circular No. 17, 8:11788 (R;US)
Wyoming Univ., Laramie (USA). Dept. of Chemistry
Solid-surface luminescence analysis. Progress report, June 1980-October 1982, 8:12804 (R;US)

Y

Yale Univ., New Haven, CT (USA)
Charged-hyperon production by 400-GeV/c protons, 8:13260 (R;US)
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R;US)
Yale Univ., New Haven, CT (USA). Gibbs Lab.
Low-energy-positron production at the Livermore linac, 8:12934 (R;US)
Yale Univ., New Haven, CT (USA). School of Medicine
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R;US)

Z

Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)
Central Institute of Nuclear Research Rossendorf 25 years old, 8:12472 (R;DD;In German)

PERSONAL AUTHOR INDEX

Authors' surnames are indexed in the form appearing in the abstracted publication; given names are reduced to initials. Each author entry gives the publication title and the citation number. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes. For publications with multiple authors, an entry is provided for each author. Entries for the second and succeeding authors give references to the first author.

Because of problems involved in the mechanical preparation of this index, all accent marks are omitted. Changes in spelling introduced as a result of accent omission follow standard conventions.

A

Aaldijk, J.K., *See* Zijp, W.L., 8:13548

Abbott, S., RFQ development at LBL, 8:12896 (R;US)

Abdou, M.A., *See* Stacey, W.M. Jr., 8:13480

Abe, K., Measurement of nu/sub e/ and anti nu/sub e/ elastic scattering as a test of the standard model, 8:13253 (R;US)

Abeele, W.V., Diurnal variability of wind velocity increase with height, 8:13022 (R;US)

Abel, E., *See* Ivan, J., 8:13095

Ableev, V.G., Facility for measurements of fragmentation spectra of relativistic deuterons and alpha particles, 8:12921 (R;SU;In Russian)

Abraham, K.M., Ambient temperature rechargeable lithium battery. Final report 1 Mar 81-28 Feb 82, 8:12456 (R;US)

Investigation of lithium sulfur dioxide (Li/SO2) battery safety hazards -- chemical studies. Final report 24 Dec 80-23 dec 81, 8:12454 (R;US)

Abuev, F.V., Physics of atoms and elementary particles. Semantic collection of scientific papers, 8:13251 (R;SU;RU)

Adam, D.P., *See* Sims, J.D., 8:12194

Adam, R.F.J., Returning coal waste underground. Phase I: report addendum, 8:11732 (R;US)

Adams, R.D., Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R;US)

Adams, R.J., Aircraft/air carrier energy conservation measures, status and operational constraints to additional implementation, 8:12592 (RA;US)

Adams, S.R., *See* Rich, B.L., 8:12389

Adelberger, E.G., Parity-nonconserving nuclear forces, 8:13355 (R;US)

See Hoyle, C.D., 8:13315

Adriano, D.C., *See* Corey, J.C., 8:13067

Ahlen, S.P., Toward a sub-MeV personnel neutron dosimeter, 8:12984 (RA;US)

See Budiansky, M.P., 8:12995

Ahn, T.M., Container assessment: corrosion study of HLW container materials. Quarterly progress report, January-March 1982, 8:12686 (R;US)

Ahrenkiel, R.K., New class of saturable absorbers at 10.6 μm based on doped alkali halides, 8:12744 (J;US)

Ahti, K., Meteorological aspects of the transport of energy, 8:12477 (RA;CH)

Aime, M., Method for the preparation of polymers, 8:12729 (TG;US)

Aittola, J.-P., Thermal stability of ion-exchange resins, 8:11912 (R;SE)

Aksarin, N., Principles of a probabilistic/statistical approach to the estimation of potential wind energy and solar radiation, 8:12000 (RA;CH)

Akulova, N.V., Design characteristics of a cyclotron for producing radioisotopes, 8:12827 (TG;DE;GE)

Alam, M.S., *See* Panvini, R.S., 8:13252

Alberi, J.L., *See* Stubblefield, F.W., 8:12911, 8:12939

Albert, D.M., Induction of ocular neoplasms in Fischer rats by intraocular injection of nickel subsulfide, 8:13185 (J;US)

Alberts, W.G., Investigation of the energy dependence of the equivalent dose rate ludication protection purposes, 8:12956 (RA;DE;In German)

Albrecht, M.C., Introduction to coal preparation, 8:11741 (RA;US)

Albright, J.N., Subsurface subsidence damage monitoring: acoustic tomography and microgravimetry, 8:13060 (R;US)

Albright, S., Solar domestic hot water project, 8:12137 (RA;US)

Aldridge, T.L., *See* Robinson, B., 8:13148

Alenitskij, Yu.G., Magnetic field shaping for the JINR phasotron, 8:12902 (R;SU;In Russian)

Alexander, J.H., Systems model of the iron oxide hot-gas clean-up process. Volume 1. Theoretical and experimental results. Final report, September 1979-December 1980, 8:11660 (R;US)

Alexander, W.A., Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R;US)

Alexander, W.G., *See* Ethridge, F.C., 8:11622

Alhajji, J., *See* Ghoniem, N.M., 8:12661

Alkezweeny, A.J., Comparison of ozone in polluted and clean air masses over Lake Michigan, 8:13036 (BA;US)

Allen, A.B., Production of fuel grade peat at First Colony Farms, Inc., 8:11739 (RA;US)

Testing of sod peat equipment and elucidation of sod dewatering characteristics, 8:11729 (RA;US)

Allen, C.C., Partial-equilibrium model based on the kinetics of dissolution and equilibrium in solution of the UO_2-FeS_2-$Fe_2(SO_4)_3$-H_2SO_4 system, 8:12823 (R;US)

Allen, D.R., Adventures in joint ventures: issues facing attorneys and managers in joint-action power projects, 8:12503 (R;US)

Allen, G., *See* Goldstone, P.D., 8:13485

Allen, L.H. Jr., *See* Baker, D.N., 8:13025

Allen, R., *See* Sun, C.R., 8:13243

Allen, R.D., *See* Chang, G.C., 8:12450

Allen, R.P., Development of improved technology for decommissioning operations, 8:11903 (R;US)

Almaliev, A.N., *See* Batkin, I.S., 8:13240

Alonso, J.R., Advanced medical accelerator design, 8:12925 (R;US)

Alpert, D.J., *See* Ostmeyer, R.M., 8:12430

Als-Nielsen, J., Synchrotron X-ray diffraction from liquid crystals, perfect crystals and perfect liquid crystals, 8:13375 (RA;DK;In Danish)

Alsmiller, R.G. Jr., *See* Santoro, R.T., 8:13492

Alvarez, R.A., *See* Howell, R.H., 8:12934

Alvin, M.A., *See* Ciliberti, D.F., 8:11627

Ambrose, K.R., *See* Knapp, F.F. Jr., 8:13131

An, T.D., *See* Rogers, D.Z., 8:12083

Anan'in, O.B., Study on laser plasma as a source of multicharged ions for cyclotrons in the light element range (Li,Be,C), 8:12922 (R;SU;In Russian)

Anders, E., *See* Hayatsu, R., 8:13234

Andersen, F., *See* Lyons, J.A., 8:13210

Anderson, C.W., *See* Semelr, B.L., 8:13108

Anderson, D.R., Department of Energy ocean-disposal programs: complements to land-based disposal, 8:11911 (R;US)

Seventh International NEA/Seabed Working Group Meeting, 8:11907 (R;US)

Anderson, D.W., Thermal and radiative properties of coal-ash deposits. Technical progress report No. 4, September 1-November 30, 1982, 8:11671 (R;US)

Anderson, E.W., *See* Teig, L.J., 8:13260

Anderson, L.E., *See* Phillips, R.D., 8:13194

Anderson, M.E., Selected measurement data for plutonium and uranium, 8:11940 (R;US)

Anderson, R.R., *See* Van Eck, O.J., 8:13211
Anderson, S.B., *See* Harris, K.L., 8:12198
Anderson, T.D., *See* Livingston, R.S., 8:12490
Anderson, W.A., *See* Cameron, C.C., 8:11708
Andrade, A.O.M., *See* Senise, J.T., 8:12036
Andrejko, M., *See* Cohen, A.D., 8:11698
Andress, D.A., Enrichment, demand, planning, facility deployment, and pricing, 8:11932 (R;US)
International nuclear-model prototype: program descripttion, 8:12333 (R;US)
Andrews, N.J., *See* Pratt, D.C., 8:12095
Angino, E.E., *See* Kopsick, D.A., 8:11692
Ankenbrandt, C., *See* Teig, L.J., 8:13260
Antal, M.J. Jr., *See* Mok, W.S., 8:12077
Antonsen, T.M. Jr., Perturbative study of the spectrum of large toroidal mode number ideal MHD instabilities, 8:13460 (J;GB)
Apel, W.D., *See* Behrend, H.J., 8:13255
Appelbaum, H.R., *See* Feldmann, H.F., 8:12071
Apps, J.A., *See* Weres, O., 8:12238
Apsel, R.J., Effects of earthquake-rupture shallowness and local soil conditions on simulated ground motions, 8:13212 (R;US)
Argentesi, F., International safeguards data management system, 8:11934 (R;XE)
International safeguards data-management system, 8:11935 (R;XE)
Armantrout, G.A., Health physics instruments: what are the current needs, 8:12994 (R;US)
Armostrong, D.R., Formation of dry pockets during water penetration into a hot particle bed, 8:12436 (J;US)
Armstrong, W.T., *See* McKenna, K.F., 8:13441
Arnal, T., Plutonium fuel fabrication residues and wastes, 8:11865 (R;FR)
Aronovitch, J., *See* Samuni, A., 8:13180
Arpaci, V.S., *See* Merte, H. Jr., 8:12305
Artamonov, S.A., Influence of tensor component of effective interaction on the spherical odd-odd nucleus properties, 8:13328 (RA;SU;In Russian)
Artaxo Netto, P.E., *See* Prado, C.P.C. do, 8:12468
Artem'ev, N.A., Moessbauer studies of orientational transitions in substituted ferrite garnets, 8:12782 (RA;SU;In Russian)
Artemov, S.V., Restriction of the effective number of independent spin channels in a fluctuation analysis, 8:13317 (RA;SU;In Russian)
Ashare, E., *See* Ruoff, C.F., 8:11607
Ashcraft, R.W., Reproducibility of the Langlie Technique for establishing probabilities of LX-10 skid initiation, 8:13010 (R;US)
Ashe, G., Notes for an address on coal, 8:11787 (R;CA)
Askew, G.L., *See* Chaffin, D.J., 8:12147
Asmis, G.J.K., Role of regulatory body related to siting, 8:12365 (R;CA)
Asmussen, D., State resource estimation: Minnesota, 8:11696 (RA;US)
Aspliden, C.I., *See* Elliott, D.L., 8:12256
Asplund, D., Peat research in Finland, 8:11580 (RA;US)
Athens, P., Prevention and control of LNG tanker spills with membrane barrier systems inside cargo tanks. Final technical report, October 1981-November 1982, 8:13027 (R;US)
Athey, C. III, NLTSS/LINCS for a presentation to Nuclear Software Systems Division, 8:13567 (R;US)
Atkins, H.L., *See* Oster, Z.H., 8:13176
Attalla, A., *See* Bowan, R.C. Jr., 8:12719
Attwood, D.T., Compression measurement in laser driven implosion experiments, 8:13528 (BA;US)
Auchampaugh, G.F., *See* Extermann, R.C., 8:13001
Aulisio, C., *See* McGowin, C.R., 8:11768
Ault, J.W., *See* Blevins, T.R., 8:11793
Aungst, W.K., Solar domestic hot water monitoring - what we have learned, 8:12148 (RA;US)
Austin, C., Special requirements and procedures for geothermal development on Navy lands, 8:12226 (RA;US)
Austin, C.F., Opportunities for industry in the development of geothermal energy at US military installations, 8:12184 (RA;US)
Avery, J.W., *See* Abraham, K.M., 8:12456
Avignone, F.T. III, Calculations of the interference of annihilation radiations with positron spectra in a Ge detector, 8:13000 (J;NL)
Aviles, L.A., *See* Haight, R.C., 8:12909
Avitzour, A.R., Fast A/D conversion and processing system based on video digitizing of oscilloscope traces. Progress report, July 1981-June 1982, 8:13006 (R;US)
Avotina, M.P., Systematics of odd nucleus magnetic moments. Spin of the 4.48 MeV ^{93}Mo state, 8:13331 (RA;SU;In Russian)
Avramenko, S.A., *See* Ableev, V.G., 8:12921
Awschalom, M., *See* Gollon, P.J., 8:12999
Axelrod, L., Synthetic Fuels Corporation progress to date with indications for the future, 8:12485 (RA;US)
Axisa, *See* Guidez, J., 8:12349
Azevedo, J.B.L. de, *See* Muniz, A.A., 8:12304

B

Babcock, C., *See* Baker, W., 8:12352
Babcock, S.M., *See* Martin, H.L., 8:12840
Babelay, E.F. Jr., *See* Douglass, S.S., 8:12857
Babenkov, M.I., Auger KMM transitions of thulium arising in $_{70}^{160}$Yb decay, 8:13239 (RA;SU;In Russian)
Babikova, Yu.F., *See* Artem'ev, N.A., 8:12782
Babu, S.P., *See* Kosowski, G.M., 8:12072
Babuska, I., Report on progress and results obtained under contract No. AS05-76-ER03443 until October 31, 1980, 8:13544 (R;US)
Baca, T.J., Evaluation and control of conservatism in drop-table shock tests, 8:12883 (R;US)
Bacon, M.E., *See* Daniels, S.W., 8:13457
Bacon, M.P., *See* Spencer, D.W., 8:13093
Badaev, O.P., *See* Kolesnikov, N.N., 8:13368
Badalov, S.A., Algebraic realization of the resonating-group method for multichannel scattering problem in eight nucleons system, 8:13306 (RA;SU;In Russian)
Effective interaction and structure of odd spherical nuclei, 8:13346 (RA;SU;In Russian)
Bade, N.E., America's overlooked energy resource: the intercity bus, 8:12601 (RA;US)
Baer, D.R., *See* Jones, R.H., 8:12760
Bainton, D.F., *See* Werb, Z., 8:13123
Bair, J.K., Neutron yields from the 4-12 MeV proton bombardment of ^{11}B, ^{13}C and ^{18}O as related to the production of ^{11}C, ^{13}N and ^{18}f, 8:13314 (J;GB)
Bajpai, S.N., *See* Zalosh, R.G., 8:12831
Baker, D.A., The status of reversed-field pinch experiments, 8:13456 (J;US)
Baker, D.N., Effects of increased CO_2 on photosynthesis and agricultural productivity. Volume II, Part 6. Environmental and societal consequences of a possible CO_2-induced climate change, 8:13025 (R;US)
Baker, G.K., Synthesis and characterization of diallyl phthalate prepolymers, 8:12722 (R;US)
Baker, J.C., CRBRP radiation protection ALARA program, 8:12440 (J;US)
Baker, J.G., Assessment of benefit-cost analysis for coal-extraction R and D, 8:11738 (R;US)
Baker, M.S., Monitoring and performance of solar domestic hot water systems in Oregon, 8:12143 (RA;US)
Baker, S.I., *See* Gollon, P.J., 8:12999
Baker, W., Buckling investigation of ring-stiffened cylindrical shells under unsymmetrical axial loads, 8:12352 (R;US)
Balabin, A.I., Computation of the fields in structures with spatially-uniform quadrupole focusing for electrodes of special configuration, 8:12901 (R;SU;In Russian)
Balakin, S.I., FORTRAN preprocessor in the booster synchrotron control system, 8:12918 (R;SU;In Russian)
Balbekov, V.I., MULTIC program for computing three-dimensional magnetic fields of superconducting magnets, 8:12847 (R;SU;In Russian)
Balder, J.R., Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R;NL)
Baldwin, T.S., *See* Grisham, D.L., 8:12443
Balick, L.K., Appearance of irregular tree canopies in nighttime high-resolution thermal infrared imagery, 8:13058 (J;US)
Balistocky, S., *See* Fang, J.M., 8:12565
Ballinger, M.Y., *See* Sutter, S.L., 8:13031
Ballou, L.B., *See* Patrick, W.C., 8:11854
Ballve, H., Measurements of peripherical static pressure and pressure drop in a rod bundle with helical wire wrap spacers, 8:12316 (R;BR;In Portuguese)
Baltay, C., Search for new heavy techniparticles, 8:13268 (R;US)
Bandel, W., Problems in adapting ethanol fuels to the requirements of diesel engines, 8:12644 (RA;BR)
Bander, T.J., *See* Sutter, S.L., 8:13031

Banerjee, S., *See* Behrend, H.J., 8:13255
Bankoff, S.G., *See* Sharon, A., 8:12345
Banks, C.E., Bibliography and index of Wyoming uranium through 1973. Bulletin 61, 8:11826 (R;US)
Banks, W.F., Prospects for energy conservation in the pipeline industry, 8:12589 (RA;US)
Bansleben, E., *See* Baum, B., 8:12119
Barbolini, R.R., Fuel cell cogeneration in the wastewater treatment industry, 8:12543 (BA;US)
Barcias, E.R., *See* Monts, J.K., 8:12462
Barker, R.E., *See* Doman, D.R., 8:12862
Barkman, W.E., Laser-interferometer position-feedback for precision machine tools, 8:13499 (R;US)
Barna, B.A., Flaw characterization with ultrasonic phase and frequency information, 8:12879 (R;US)
See Johnson, J.A., 8:12878
Barnes, C.W., Current results from the Los Alamos CTX spheromak, 8:13438 (R;US)
Sawtooth oscillations in the flux of runaway electrons to the PLT limiter, 8:13509 (J;AT)
See Hoida, H.W., 8:13437
Barnes, D.C., *See* Vahala, G., 8:13463
Barnes, J.M., *See* Santoro, R.T., 8:13492
Barnes, W.E., *See* Kaplan, E., 8:13133
Barnett, J.H., *See* Ferraro, R.J., 8:12649
Barnett, W.C., *See* Ford, W., 8:13552
Barney, G.S., Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R;US)
Barnum, J.R., *See* Pease, R.L., 8:12086
Barolli, E., *See* Prado, C.P.C. do, 8:12468
Barsin, J.A., Studies concerning the application of coal-water fuels to boilers designed for oil, 8:11762 (RA;US)
Bartel, W., Search for charged scalar particles pair produced in e^+e^- annihilation, 8:13256 (R;DE)
Barth, C.H., *See* Suss, H., 8:12683
Barthelemy, R.R., Defense applications of fuel cells, 8:12535 (BA;US)
Bartholomew, C.H., Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R;US)
Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982, 8:11645 (R;US)
Barton, R.T., Development of a multimaterial, two-dimensional, arbitrary Lagrangian-Eulerian mesh computer program, 8:13569 (R;US)
Barton, V.C., *See* Crawford, P.C., 8:13016
Barts, B.I., Collective excitations of nuclear matter in the adiabatic time-dependent Hartree-Fock theory, 8:13361 (RA;SU;In Russian)
Bartsch, R.A., Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R;US)
See Beck, S.R., 8:12069
Bartsch, R.R., *See* McKenna, K.F., 8:13441
Barut, A., Shape of tachyons, 8:13406 (R;IT)
Basham, P.W., *See* Lyons, J.A., 8:13210
Bass, B.R., Applications of energy release rate techniques to part-through cracks in plates and cylinders. Volume 1. ORMGEN-3D: a finite element mesh generator for 3-dimensional crack geometries, 8:12353 (R;US)
Bassham, J.A., *See* Larsen, P.O., 8:13122
Bastrukov, S.I., *See* Solov'ev, V.G., 8:13356
Batalin, V.A., Irreversible processes in a binary system of an electron cooling channel, 8:12900 (R;SU;In Russian)
Bate, L.C., Iodine-129 separation and determination by neutron activation analysis, 8:12771 (J;CH)
Bateman, G., *See* Cooper, W.A., 8:13523
Bates, J.K., Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J;CH)
Batkin, I.S., Relativistic electron bremsstrahlung in the resonance electromagnetic field, 8:13240 (RA;SU;In Russian)
Bauer, S.J., *See* Friedman, M., 8:13217
Baum, B., Uv protective coatings for heliostats and the plastic dome. Final technical report, 8:12119 (R;US)
Baynard, D.N., *See* Hower, J.C., 8:11669
Bayne, C.K., *See* Brazell, R.S., 8:13189
Bayne, P.D., Development of high alcohol tolerant organisms. I. Strain selection and screening. Annual report, 31 July 1981-1 August 1982, 8:11973 (R;US)
Bazan, G., Energy conservation in Mexico, 8:12547 (RA;CH)
Beard, D.S., *See* Haubenreich, P.N., 8:13503
Beauchamp, E.K., Densification kinetics of shock-activated nitrides, 8:12715 (R;US)
Beck, S.R., Application of SGFM technology to alternate feedstocks: Phase III, 8:12069 (RA;US)
Becker, E.W., Importance of radiolytic decomposition of uranium hexafluoride in the course of uranium-235 enrichment under the separation nozzle method, 8:11843 (R;DE;In German)
Becker, N.M., Supplementary documentation for an environmental impact statement regarding the Pantex Plant: hydrologic study for the Iowa Army Ammunition Plant, 8:13074 (R;US)
Beckner, W.D., Recent advances in evaluation of BWR loss-of-coolant accident, 8:12424 (J;US)
Bedford, R.G., *See* Crawford, P.C., 8:13016
Beer, H., *See* Walter, G., 8:13229
Begovich, J.M., Multicomponent separations using a continuous annular chromatograph, 8:12759 (R;US)
Begzhanov, R.B., States of negative parity in even-even nuclei, 8:13353 (RA;SU;In Russian)
Behn, R., *See* Salzmann, H., 8:13432
Behrend, H.J., Analysis of the energy weighted angular correlations in hadronic e^+e^- annihilations at 22 and 34 GeV, 8:13255 (R;DE)
Behrin, E., Analysis and comparison of automotive-propulsion systems, 8:12643 (R;US)
Analysis and comparison of automotive-propulsion systems, 8:12647 (R;US)
Belen'kij, V.M., Possible interpretation of the negative parity quasi- rotational band structure of ^{156}Er, 8:13340 (RA;SU;In Russian)
See Badalov, S.A., 8:13346
See Begzhanov, R.B., 8:13353
Bell, M., *See* Johnson, D., 8:13449
Bell, R.A., 4.8 MW fuel cell demonstratrator: a step toward commercialization, 8:12540 (BA;US)
Bellows, R.J., *See* Malachesky, P.A., 8:12651
Beltrami, G., *See* Rota, G., 8:11823
Belytschko, T.B., *See* Santee, G.E. Jr., 8:12390
Benjamin, A.S., Degraded core aspects of Sandia's probabilistic and cost-benefits programs, 8:12437 (J;US)
Bennett, D.E., Allowable shipment frequencies for the transport of toxic gases near nuclear power plants, 8:13184 (R;US)
Bennett, J., *See* Baker, W., 8:12352
Bennett, M.R., Oxidation of hydroxylamine by nitrous and nitric acid, 8:12808 (J;US)
Bennington, K.O., Thermodynamic proprties of petalite ($Li_2Al_2Si_8O_{20}$), 8:13215 (R;US)
Bensinger, J., Search for production of narrow p anti p states with a 5 GeV/c p beam, 8:13254 (R;US)
Benson, S.A., Structural characteristics and relationships in low-rank coals, 8:11676 (RA;US)
See Talty, R.D., 8:11769
Bentley, J., *See* Hildebrandt, A.F., 8:12578
Benton, W.J., *See* Miller, C.A., 8:11801
Bentz, E.J. Jr., *See* Salmon, E.J., 8:12032
Berger, J.D., *See* Krupar, J.J., 8:12445
See Taylor, D.S., 8:12446
Berkeley, A.D., Electric utilities and natural gas use, 8:12484 (R;US)
Berkowitz, N., Some inconsistencies in current concepts of coal science, 8:11674 (RA;US)
Berlin, R.E., Low-level radioactive waste disposal: commercial facilities no longer operating, 8:11871 (RA;US)
Berndt, C.C., Characterization of imperfections in plasma-sprayed titania, 8:12708 (R;US)
Bernhard, R.P., *See* Guven, N., 8:12249
Berry, J.R., 1976 Hanford americium-exposure incident: decontamination and treatment facility, 8:13146 (R;US)
See Jech, J.J., 8:13145
Bertalot, L., *See* Deutsch, R., 8:13428, 8:13484
Bertilsson, B.M., Assessment of environmental impacts of production, distribution and utilization of alcohol and biomass fuels, 8:12026 (RA;BR)
Berwager, S.D., Transportation conservation: can we deliver, 8:12610 (RA;US)
Berwald, D.H., *See* Garner, J.K., 8:13519
See Youssef, M.Z., 8:13520
Besmann, T.M., *See* Livingston, R.S., 8:12490
Bethiol, A.E., *See* Serra, C.E., 8:12037
Beuttenmuller, R., *See* Kraner, H.W., 8:12943
Bevilacqua, L., *See* Muller, A., 8:12853
Beyer, G., Passive-solar heating and cooling demonstration project. Final report, 8:12168 (R;US)
Beyerle, A., Characterization of single-crystal mercuric iodide (HgI_2) using

thick detector structures, 8:12731 (R;US)
See Hull, K., 8:12946
Bhang, H.C., *See* Lynch, W.G., 8:13344
Bhat, N.P., Determination of carbon in sodium by the distillation-combustion method, 8:12319 (R;IN)
Bhattacharya, P.K., Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R;US)
Bibber, J.W., *See* Brown, G.M., 8:12795
Bibler, N.E., Characterization of borosilicate glass containing Savannah River Plant radioactive waste, 8:11878 (R;US)
Bicking, M.K.L., New analytical techniques for mycotoxins in complex organic matrices, 8:12757 (R;US)
Biefeld, R.M., *See* Brinkmann, D., 8:12698
See Gourley, P.L., 8:12886
Biehl, F.A., *See* Wray, W.O., 8:12161
Bier, W., *See* Becker, E.W., 8:11843
Biggs, F., *See* Kissel, L., 8:13562
Bild, R.W., Simultaneous determination of antimony and chlorine in synthetic rubbers by 14 MeV neutron activation analysis, 8:12765 (J;CH)
Biljetina, R., Peatgas pilot plant status, 8:11609 (RA;US)
Preparation for pilot plant scale peat gasification tests, 8:11605 (RA;US)
Bird, W., *See* Carder, B., 8:12448
Bird, W.A., *See* Perez-Blanco, H., 8:12614
Bishop, A.A., Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982, 8:11638 (R;US)
See Deshpande, G.V., 8:11634
Bissel, M.J., *See* Hall, H.G., 8:13119
Bitter, M., *See* Johnson, D., 8:13449
Bitterlich, H., *See* Hohmuth, K., 8:12472
Bitzenberger, B., *See* Salzmann, H., 8:13427, 8:13432
Bjerknes, C.A., *See* Van't Hof, J., 8:13107
Bjornstad, D.J., On-farm use of biomass fuels: market penetration potential during normal and fuel-emergency conditions, 8:12065 (R;US)
Black, J.W., Pressurized fluidized bed gasifier in the synthesis of methanol from wood, 8:11988 (RA;US)
Black, S., *See* Chum, H.L., 8:12092
Blair, J.S., *See* Hoyle, C.D., 8:13315
Blake, T.R., *See* Alexander, J.H., 8:11660
Blevins, T.R., Light oil steamflooding: an emerging technology, 8:11793 (RA;US)
Blinov, M.V., ^{233}U and ^{233}Th levels excited in the (n, n') reactions with 3 MeV neutrons, 8:13352 (RA;SU;In Russian)
Bliss, R.W., Federal legislation affecting geothermal development, 8:12222 (RA;US)
Bliss, W., Enewetak fact book (a resume of pre-cleanup information), 8:13013 (R;US)
Blocki, J., Nuclear-deformation energies according to a liquid-drop model with a sharp surface, 8:13335 (R;US)
Blokhin, A.I., *See* Katan, I.B., 8:13549
Blomquist, C.A., *See* Chang, G.C., 8:12450
Bloom, E.D., Gluonium and QCD in the J/psi region, 8:13280 (R;US)
Bloomfield, P., Least absolute deviations regression, 8:13414 (R;US)
Blose, R.E., *See* Tarbell, W.W., 8:12419
Bloss, W.H., Technological aspects of solar energy utilization, 8:12107 (RA;CH)
Blythe, G.M., Dry-limestone injection test at a low-rank coal-fired power plant. Final report, 8:12282 (R;US)
Boardman, C.R., *See* Rogers, L.A., 8:12186
Boatner, L.A., *See* Sales, B.C., 8:11867
Bobrov, S.B., *See* Kujal, J., 8:12321
Bobykin, B.V., *See* Babenkov, M.I., 8:13239
Bodamer, J.W. Jr., IGT U-GAS pilot plant scrubber effluent analysis, 8:11682 (R;US)
Bodenkamp, J., *See* Behrend, H.J., 8:13255
Bodin, S., Swedish meteorologial programme related to solar and wind energy, 8:12009 (RA;CH)
Bodner, S.E., *See* Emery, M.H., 8:13487
See Stamper, J.A., 8:13524
Boegner, F., Fuel oil substitution by enriched medium Btu gas produced from coal in Winkler fluidized gasifiers, 8:11590 (RA;US)
Boehm, J., Secondary calibration standard for the radiation dose of beta radiation in tissue, 8:13386 (RA;DE;In German)
Boeri, G.B., *See* Gudiksen, P., 8:13196
Boettcher, B., *See* Wade, D., 8:12274
Bogdanov, P.V., *See* Akulova, N.V., 8:12827
Bogdanov, Yu.P., Covariant description of magnetic and electric properties of extended nuclei with half-integral spin in electronscattering, 8:13310 (RA;SU;In Russian)
Electromagnetic and weak scattering of electrons by the 1p shell nuclei and space parity violation, 8:13311 (RA;SU;In Russian)
Boggs, T.A., *See* Millemann, R.E., 8:13063
Bogner, J.E., Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs, 8:11681 (R;US)
Bohning, D.E., *See* Harley, N.H., 8:13171
Bohr, J., Melting of two-dimensional argon film on graphite. A continuous melting, 8:12736 (RA;DK;In Danish)
Boland, W.R., VAXMATH: a mathematical software library for the VAX, 8:13553 (R;US)
Bolczak, R., Prototype tramp-metal separator: a summary of test results, 8:12633 (R;US)
Bolkcom, J., Trombe wall performance study in the Upper-Midwest. Final report, 8:12156 (R;US)
Bolle, T., *See* Hansen, D., 8:12548
Bolotin, Yu.L., *See* Barts, B.I., 8:13361
Bond, H.H., *See* Bond, S.K., 8:12573
Bond, J.G., *See* Venkatakrishnan, R., 8:13208
Bond, S.K., Energy-conservation potential from optimized mass flow and temperature differences in cooling systems. Final report, 8:12573 (R;US)
Bondietti, E.A., *See* Drury, J.S., 8:13084
See Lee, S.Y., 8:13086
Boni, A.L., *See* Corey, J.C., 8:13067
Bonnet, J., *See* Moyzis, R.K., 8:13114, 8:13115
Boothroyd, J., State resource estimation: Rhode Island, 8:11699 (RA;US)
Borek, C., Protease inhibitors neither damage DNA nor interfere with DNA repair or replication in human cells, 8:13113 (J;NL)
Borg, D.C., Session X: regulatory risk assessment, 8:13187 (BA;US)
Boris, J.P., *See* Emery, M.H., 8:13487
Borkowski, R.J., *See* Bjornstad, D.J., 8:12065
Bortnyanskij, A.L., Determination of energetic parameters of the beam of the EhGP-10-P charge-exchange electrostatic accelerator, 8:12928 (R;SU;In Russian)
Boruta, I.I., Exchange and overlap corrections to probabilities of electron capture by iodine nuclei in atoms and ions, 8:13330 (RA;SU;In Russian)
Borzov, I.N., *See* Tolokonnikov, S.V., 8:13304
Bosco, F.A.R., *See* Prado, C.P.C. do, 8:12468
Bossert, W., Investigations on the structure and polymorphy of the dibromides of dysprosium, thulium, ytterbium and calcium, 8:12781 (R;DE;In German)
Bott, T.F., TRAC-PD2 Calculations of CREARE countercurrent flow tests, 8:12298 (J;US)
Boucher, L.J., New catalysts for coal-liquid upgrading. Quarterly report, September 1-December 31, 1982, 8:11637 (R;US)
Bouchillon, C.W., Study of hydrocyclone applications to separation processes for coal preparation. Final report, 8:11751 (R;US)
Boudreau, R.A., *See* Langmuir, M.E., 8:12023
Boultinghouse, K.D., Development of a solar-flux tracker for parabolic-trough collectors, 8:12180 (R;US)
Bourdo, E.A. Jr., *See* Mogk, J.E., 8:11695
Bourne, S., *See* Jirka, A., 8:13178
Bova, L., *See* Armostrong, D.R., 8:12436
Bowan, R.C. Jr., NMR study of phase transitions in VT/sub 0.50/ and VT/sub 0.75/, 8:12719 (J;US)
Bowden, J.R., How industry views the climate for major synfuels investment in the 80's, 8:11772 (RA;US)
Bowen, B.M., Measurements and modeling of gamma absorbed doses due to releases from a linear proton accelerator: experimental design and preliminary results, 8:13043 (R;US)
Bowling, C.C., *See* Lloyd, W.G., 8:11672
Bowsher, C.A., Obstacles to US ability to control and track weapons-grade uranium supplied abroad, 8:11936 (R;US)
Boyd, F.C., Licensing and safety of nuclear power plants in Canada, 8:12325 (R;CA)
Boyd, P., State of the art: steam hydrocarbon reforming, 8:11955 (RA;US)
Brabant, R. van, Study of the corrosion products in the primary system of PWR plants as the source of radiation fields build-up, 8:12299 (R;BE)

Braby, L.A., Microdosimetry of 0.5 to 2.0 MeV electron beams, 8:13392 (R;US)
Brackenbush, L.W., Personnel neutron dosimeters based on organic polymers, 8:12978 (RA;US)
Bradley, D.R., Heat, mass, and momentum transfer from large two-phase bubbles, 8:12320 (D;US)
Braga, C.V.M., Effect of tube plugging in the thermalhydraulic performance of 'U' tube steam generators, 8:12309 (R;BR;In Portuguese)
Braginski, A.I., *See* Sletten, A.M., 8:12668
Brainard, A.J., Eighth annual international conference on coal gasification, liquefaction, and conversion to electricity, 8:11584 (R;US)
Brainard, W.A., Worldwide market for photovoltaics in the rural sector, 8:12015 (R;US)
Brak, S.B., Bag-out material-handling system, 8:12861 (P;US)
Brandon, W.E., Calibration of neutron dosimetry techniques for use in reactor buildings, 8:12991 (RA;US)
Brandt, D.L., *See* Maier, R.W., 8:11808
Brandt, J.J., Timing and control monitor system requirements: an overview, 8:13015 (R;US)
Branz, H.M., Photovoltaic-array/power-conditioner interface, 8:12109 (R;US)
Brauer, F.P., Interference control in low-level ^{129}I analysis, 8:12770 (J;CH)
Braun, M., *See* Wiegel, J., 8:12105
Brazell, R.S., Profile analysis of organic volatiles in urine of tobacco smoke-exposed beagles, 8:13189 (J;NL)
Brede, O., Proceedings of the 2. Working Meeting on Radiation Interaction. Selected papers - part 2, 8:12743 (R;DD)
Proceedings of the 2. Working Meeting on Radiation Interaction. Selected papers - part 1, 8:13242 (R;DD)
Breitenstein, B.D., 1976 Hanford americium exposure incident: medical management and chelation therapy, 8:13143 (R;US)
See Berry, J.R., 8:13146
See Jech, J.J., 8:13145
See Ragan, H.A., 8:13149
Breitenstein, B.D. Jr., *See* Moore, R.H., 8:12828
Brennan, M., Testing of sliding electrical contacts for homopolar generators, 8:13470 (R;US)
Brenot, J.C., *See* Fayeton, J.A., 8:13244
Bretscher, M.M., Neutronic performance of a 14-MW TRIGA reactor LEU vs HEU Fuel, 8:12375 (J;US)
Bretz, N., *See* Strachan, J.D., 8:13501
Brevik, I., Measurement and modelling of solar radiance, 8:12003 (RA;CH)
Brewer, L., Mathematical representation of size and electronic factors, 8:13404 (R;US)
Brewer, P.G., *See* Spencer, D.W., 8:13093
Brianson, Sh.I., Determination of the core inertial characteristics according to the data on the aligned angular moment of the octupole bands, 8:13357 (RA;SU;In Russian)
Brigham, T.B., TOFC shuttle trains vs. double trailer trucks, 8:12590 (RA;US)
Brill, A.B., *See* Oster, Z.H., 8:13176
Brillant, M., Electron-beam welding of aluminum alloys, 8:12704 (TJ;US)
Brinati, H., *See* de Oliveira, S. Jr., 8:12040
Brinckmann, H.F., *See* Hohmuth, K., 8:12472
Brinkman, N.D., Engine study of efficiency and fuel consumption with ethanol fuel, 8:12653 (RA;BR)
Brinkmann, D., NMR in doped monocrystals of superionic conductor β-$LiAlSiO_4$ (β-eukryptite), 8:12698 (J;CH;In German)
Brittain, H.G., Luminescence studies of lanthanide oxides. I. Thermal and hydration effects on the metal ion site symmetry in europium oxide catalysts, 8:12794 (J;US)
Brockett, G.F., *See* Santee, G.E. Jr., 8:12390
Brodie, L.C., *See* Sinha, D.N., 8:13249
Brodsky, S.J., Testing quantum chromodynamics, 8:13290 (R;US)
Brodzik, D., *See* Abbott, S., 8:12896
Bromberg, J.P., Bubbles, existing and new under the Clean Air Act, 8:13051 (RA;US)
Brook, C.A., Variability and sources of hydrogen sulfide and other gases in steam at The Geysers, 8:12210 (RA;US)
Brown, D.W., Los Alamos hot-dry-rock project: recent results, 8:12245 (R;US)
Brown, G.M., Poly(tertiary phosphines and arsines). 18. Preparation and structure of bis{μ-[(methylamino)bis(dimethoxyphosphine)]}-bis(dicabonylcobalt), a binuclear complex with approximate square-pyramidal and triganol-bipyramidal coordination of cobalt atoms in the same molecule, 8:12795 (J;US)
See Bennett, M.R., 8:12808
Brown, G.S., *See* Moncton, D.E., 8:12913
Brown, I.M., Characterization of Kevlar 49 fibers by electron paramagnetic resonance. Final report, 20 May 1981-20 June 1982, 8:12726 (R;US)
Brown, J.C., Fluorescence-line-narrowing spectrometry of polycyclic aromatic hydrocarbons in organic glasses, 8:12755 (R;US)
Brown, K.A., *See* Hatcher, J.J., 8:12860
Brown, M.S., *See* Webb, R.B., 8:13164
Brown, S.L., *See* Baker, J.C., 8:12440
Brown, S.M., Contaminant migration and fate research at Pacific Northwest Laboratory, 8:13045 (R;US)
Brown, T., Passive-solar collector: a Trombe'-wall retrofit guide, 8:12158 (R;US)
Brown, T.D., *See* Lee, G.K., 8:11722
Brown, W.R., 1976 Hanford americium exposure incident: psychological aspects, 8:13144 (R;US)
Brown, W.T., Cooperative passive-solar commercial retrofit. Final report, September 1, 1980-December 31, 1982, 8:12155 (R;US)
Brownell, D.H. Jr., *See* Alexander, J.H., 8:11660
Broyde, S., *See* Santella, R.M., 8:13193
Bruckner, A.P., High-temperature integrated thermal-energy-storage system for solar-thermal applications. Final subcontract report, 8:12181 (R;US)
Bruemmer, S.M., *See* Jones, R.H., 8:12760
Brummert, L., One-inch flexible drill for resin bolter module. Final technical report, Phases I and II, September 30, 1977-April 30, 1981, 8:12845 (R;US)
Brunengo, C., *See* Engelhard, M., 8:12401
Brunet, C., SAMSS: computer-aid system for the preparation of social-science models. Reference and implementation instruction manual. Final report, 8:13097 (R;XE)
Brunetti, F., *See* Nanni, H., 8:12654
Bryan, R.H., *See* Whitman, G.D., 8:12294
Bryant, F., *See* Ljungdahl, L.G., 8:13135
Bryant, J., *See* Hewitt, R., 8:12459
Bryson, J.W., *See* Bass, B.R., 8:12353
Buchanan, R.J., Portable instrumentation for processing information from selected personnel neutron dosimetry detectors, 8:13372 (RA;US)
Bucher, J., *See* Edelstein, N., 8:12825
Bucholz, J.A., Scoping design analyses for optimized shipping casks containing 1-, 2-, 3-, 5-, 7-, or 10-year-old PWR spent fuel, 8:12855 (R;US)
Buck, A.D., *See* Rhoderick, J.E., 8:12740
Budiansky, M.P., Lead-glass gamma-ray detector for relativistic heavy-ion collisions, 8:12995 (J;NL)
Budtz-Joergensen, C., *See* Meadows, J.W., 8:13348
Budtz-Jorgensen, C., Fast-neutron elastic-scattering cross sections of elemental tin, 8:13320 (R;US)
Buelt, J.L., Feasibility of vitrifying EPICOR II organic resins, 8:12394 (R;US)
Buescher, B.J., Degraded core studies at INEL, 8:12434 (J;US)
Bufe, C.G., Seismicity of the Geysers-Clear Lake region, 8:12193 (RA;US)
Buff, R., *See* Rosenstock, H.M., 8:12809
Buhl, T., *See* Van Etten, D., 8:13042
Buhl, T.E., *See* Bowen, B.M., 8:13043
Bulgak, A., *See* Zhalov, M.B., 8:13327
Bulos, F., Physics with linear colliders in the TeV CM energy region, 8:12897 (R;US)
Bunick, G.J., *See* Uberbacher, E.C., 8:13105
Buras, B., *See* Staun Olsen, J., 8:12778
Burch, S.F., Evaluation of a computer aided X-ray fluorographic system: part 1 - system analysis, 8:12876 (R;GB)
Burch, W.D., Nuclear-fuel-cycle costs. Consolidated Fuel-Reprocessing Program, 8:11847 (R;US)
Burchill, W.E., Physical phenomena of a small-break loss-of-coolant accident in a PWR, 8:12423 (J;US)
Burger, L.L., Recycle of iodine-loaded silver mordenite by hydrogen reduction, 8:11900 (R;US)
Burgess, D.R., Irreversible cooperative processes on lattices, 8:12790 (R;US)
Burgess, P.H., Mini-instruments environmental monitor Type 5.10G. Instrument evaluation no. 21, 8:12975 (R;GB)
Burgkhardt, B., Calibration of TLD-readers with standard light sources, 8:12954 (RA;DE;In German)
Dosimetric properties of moderator-type neutron detectors, 8:12955 (RA;DE;In German)
Results of an inquiry concerning experience gained in the use of thermoluminescent and phosphate glass dosemeters, 8:12952 (RA;DE;In German)

See Piesch, E., 8:12957, 8:12959, 8:12986, 8:12987
Burnett, T.D., Monitoring solar water heater performance by alternating between resistance and solar systems, 8:12144 (RA;US)
Burns, F.J., Oncogenic action of ionizing radiation on rat skin. Comprehensive progress report, February 1, 1980-January 31, 1983, 8:13141 (R;US)
Burns, L.K., *See* Ethridge, F.C., 8:11622
Burns, R.E., Funding nuclear-power-plant decommissioning. Final report, 8:12336 (R;US)
Burr, B., Detection of changes in maize DNA at the shrunken locus due to the intervention of Ds elements, 8:13125 (J;US)
Ds controlling elements of maize at the shrunken locus are large and dissimilar insertions, 8:13124 (J;US)
See Burr, F.A., 8:13106
Burr, F.A., Three mutations in Zea mays affecting zein accumulation: a comparison of zein polypeptides, in vitro synthesis and processing, mRNA levels, and genomic organization, 8:13106 (J;US)
See Burr, B., 8:13124, 8:13125
Burris, R.D., *See* Young, K.G., 8:13444
Burrows, T.W., *See* Rose, P.F., 8:13321
Burton, J.H., *See* Doman, D.R., 8:12862
Busch, N.E., Technological aspects of the mixed use of solar and wind energy, 8:12108 (RA;CH)
Busey, R.H., *See* Patterson, C.S., 8:12254
Bushnell, D., *See* Meller, E., 8:12296, 8:12350
Busse, L.J., *See* Collins, H.D., 8:12881
Bussiere, J.F., Effects of ternary additions on Young's modulus and the martensitic transformation of Nb_3Sn, 8:12659 (R;US)
Butkovich, T.R., Effects of boundary conditions on thermomechanical calculations: Spent fuel test - climax, 8:11913 (R;US)
Butler, T.A., *See* Knapp, F.F. Jr., 8:13131
Buxbaum, R.E., Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium, 8:13495 (R;US)
Byerly, D., *See* Lomenick, T.F., 8:11898
Bykov, A.A., Calculations of half-life of deformed and spherical nuclei, 8:13341 (RA;SU;In Russian)
Strength functions of β^+ decay of cesium isotopes, 8:13329 (RA;SU;In Russian)
Bykovskij, Yu.A., *See* Anan'in, O.B., 8:12922
Bywaters, R.P., Development of the commercial air conditioning with thermal-energy-storage concept: Phase I. Final report, 8:12572 (R;US)

C

Cadwell, L.L., *See* Kennedy, W.E. Jr., 8:11901
Cady, W.E., Evaluation of the use of HiSil 233 in silicone elastomers and cellular silicones, 8:12727 (R;US)
Caldas, L., *See* Regulla, D.F., 8:13385
Calderwood, F.W., *See* Gschneidner, K.A. Jr., 8:12673
Callen, J.D., *See* Shaing, K.C., 8:13507
Camargo, C.T.M., Insertion of control systems models in the Almod 3 computer code for the simulation of Angra I reactor start-up tests, 8:12301 (R;BR;In Portuguese)
Cambell, E.M., *See* Attwood, D.T., 8:13528
Cameron, C.C., Maine peat resource evaluation program, 8:11708 (RA;US)
Campbell, J.E., *See* Chu, M.S., 8:11910
Campbell, R.W., *See* Jackson, W.P., 8:12750
Campos, L.L., *See* Kathuria, S.P., 8:12966
Canale-Parola, E., Conversion of cellulose to ethanol by mesophilic bacteria. Progress report and third year budget, 8:11971 (R;US)
Canney, P.J., *See* Copa, W.M., 8:11667
Caplan, M., *See* Tancredi, J.J., 8:13489
Capobianco, C., Calorimetric evidence for ideal mixing of silicon and germanium in glasses and crystals of sodium feldspar composition, 8:13222 (J;US)
Caracciolo, R., *See* Gudiksen, P., 8:13196
Carajilescov, P., Semi-empirical model for the calculation of flow friction factors in wire-wrapped rod bundles, 8:12317 (R;BR;In Portuguese)
See Ballve, H., 8:12316
See Braga, C.V.M., 8:12309
See Fernandez y Fernandez, E., 8:12318
Carbaugh, E.H., Survey of HEPA filter experience, 8:13046 (R;US)
Carden, R.S., Unique aspects of drilling and completing hot-dry-rock geothermal wells, 8:12246 (R;US)
Carder, B., Rotary flux compressor: a new high-power compact energy store, 8:12448 (R;US)
Carlisle, C.T., Development of a rapid and accurate method for determining partition coefficients of chemical tracers between oils and brines (for single well tracer tests). Final report, 8:11796 (R;US)
Carlson, G.A., *See* Henning, C.D., 8:13468
Carlson, J.B., Development of data-acquisition-and-analysis systems for in-beam gamma-ray spectroscopy: a study of the nucleus ^{180}W, 8:13343 (R;US)
Carlson, R.L., *See* DeMerschman, A.W., 8:11937
Carmichael, L.A., *See* Chexal, V.K., 8:12425
Carney, L.L., *See* Guven, N., 8:12249
Carpenter, P.F., A field test using DRDF in a spreader stoker hot water generator. Final report Sep 80-Jul 81, 8:12891 (R;US)
Carpenter, R.H., Evaluation of uranium geochemical anomalies in the Charlotte 1° x 2° NTMS quadrangle, 8:11829 (R;US)
Carr, D.B., Estimating tail probabilities, 8:13408 (R;US)
Carreira, L., *See* Ljungdahl, L.G., 8:13135
Carrigan, R.A. Jr., *See* Sun, C.R., 8:13243
Carroll, J.B., *See* Geaga, J.V., 8:13313
Carstea, D., Environmental data requirements and analysis for development of peat program, 8:11688 (RA;US)
Carty, R.H., *See* Remick, R.J., 8:12057
Case, F.N., *See* Haff, K.W., 8:11946
Casilli, T., *See* Argentesi, F., 8:11934, 8:11935
Caskey, G.R. Jr., Heat treating effects on environmental hydrogen embrittlement of nickel, 8:12669 (R;US)
Casper, R.A., Solar-augmented applications in industry. Phase II: conceptual designs, volume 1. Final report Jun 80-Dec 81, 8:12166 (R;US)
Casstevens, B.J., Database automation of accelerator operation, 8:12930 (R;US)
Casteel, R.W., Pliocene and Pleistocene fishes from the Clear Lake area, 8:12195 (RA;US)
Casto, W.R., Selected safety-related events reported in May and June 1982, 8:12427 (J;US)
Cate, J.L., *See* Dreicer, M., 8:13092
Cattolica, R.J., Effect of surface chemistry on the development of the [OH] in a combustion boundary layer, 8:11958 (RA;US)
Cayton, T.E., *See* Vahala, G., 8:13463
Ceglio, N.M., *See* Attwood, D.T., 8:13528
Celik, M.S., Sulfonate precipitation-redissolution-reprecipitation in inorganic electrolytes, 8:12801 (J;US)
Cereda, M.P., *See* Serra, C.E., 8:12037
Cesar, M.F., Studies of alpha particle registration in LR-115 type II. A solid state nuclear track detector, 8:12965 (R;BR)
Chaffin, D.J., Results of TVA monitoring of residential solar water heaters, 8:12147 (RA;US)
Chaing, S., Fast breeder reactor on-line monitoring and diagnosis strategy development via Dynamic Data System (DDS) methodology, 8:12364 (D;US)
Chan, L.H., Research in elementary-particle physics. Progress report, May 1, 1982-April 30, 1983, 8:13250 (R;US)
Chan, M., *See* Jang, L.K., 8:12772
Chan, M.K., *See* Sutter, S.L., 8:13031
Chan, Y., Transportation energy savings from a national conservation program: a case study of Pennsylvania, 8:12602 (RA;US)
Chang, C.H., *See* Salzmann, H., 8:13432
Chang, F.H., *See* Santee, G.E. Jr., 8:12390
Chang, F.R., Supersonic gas target for a bundle divertor plasma, 8:13504 (J;AT)
Chang, G.C., Pumped-storage hydroelectric plants with underground lower reservoirs, 8:12450 (R;US)
Chang, S.G., *See* Littlejohn, D., 8:12800
Chang, Y.I., *See* Jang, L.K., 8:12772
Chapman, L.R., Revision of the eutectoid isotherms of the uranium-chromium system, 8:12692 (R;US)
Chastagner, P., Isotope-dilution analyses of the metallic elements, 8:12752 (R;US)
Chastain, C.J., Control of proton efflux from corn root tissue by an injury-sensing mechanism, 8:13121 (J;NL)
Chaudhary, Z.H., Thermal-economic analysis of cogenerated energy recovery by mass-burning modular refuse incinerators. IIT Energy Management Report TR-82-2, 8:12639 (R;US)
Chechetenko, V.F., *See* Derkach, A.Ya., 8:12924
Chen, A.I., *See* Bowen, B.M., 8:13043

Chen, B.K., *See* Fitzer, J., 8:12111
Chen, C., *See* Behrend, H.J., 8:13255
Chen, C.M., Electrochemical behavior of ferrous and ferric ions in EDTA/N_2H_4 solutions, 8:12306 (R;US)
Chen, C.T.A., Increase of total CO_2 in the world oceans. Annual progress report, 8:13081 (R;US)
Chen, F.C., *See* Golshani, A., 8:12132
Chen, J.M., *See* Schindler, H.D., 8:11618
Chen, J.T., Kinetic and mechanistic studies of the reactions of selected aliphatic radicals with metal complexes and the decomposition of organoperoxy cobalt complexes, 8:12788 (R;US)
Chen, Y.M., *See* Burns, R.E., 8:12336
Cheng, H.S., *See* Diamond, D.J., 8:12444
Cheng, S.K., *See* Wong, C.N.C., 8:12314, 8:12315
Cheng, S.S., *See* Cross, W.H., 8:11684
Cheng, T.C., CONTEMPT 4/MOD 3: a multicompartment containment system analysis program, 8:12412 (R;US)
Cherry, J.A., *See* Gillham, R.W., 8:13200
Cherry, N.J., *See* Elliott, D.L., 8:12256
Chesiow, M., Effects of urban development patterns on transportation energy use, 8:12583 (RA;US)
Chesnova, S.I., *See* Alenitskij, Yu.G., 8:12902
CHester, C.V., *See* Bjornstad, D.J., 8:12065
Cheverton, R.D., The integrity of PWR pressure vessels during overcooling accidents, 8:12439 (J;US)
Chevion, M., *See* Samuni, A., 8:13180
Chewning, J.S., Manpower problems in an unsettled nuclear industry, 8:12369 (J;US)
Chexal, V.K., Neutronics analysis of Browns Ferry 3 partial control rod insertion, 8:12425 (J;US)
Chhabildas, L.C., Pressure-shear loading techniques for material-property studies, 8:12882 (R;US)
Chian, E.S.K., *See* Cross, W.H., 8:11684
Chikalla, T.D., Nuclear-waste management semiannual progress report, April 1982-September 1982, 8:11899 (R;US)
Chiu, S.C., *See* Elet, R.S., 8:13478
Cho, C.W., Inelastic deformation and phenomenological modeling of aluminum including transient effect, 8:12664 (R;US)
Cho, D.H., *See* Armostrong, D.R., 8:12436
Cho, H.Y., Development and application of a methodology for the analysis of significant human related event trends in nuclear power plants, 8:12441 (D;US)
Cho, W.D., Study of the anomalous behavior of the electrical resistivity in alloys near the $PrNi_5$ composition, 8:12682 (R;US)
Choppin, G.R., Integrative study of the behavior of transuranic elements in the marine environment. Progress report, June 1, 1982-May 31, 1983, 8:13083 (R;US)
Chopra, O.K., *See* Saltelli, A., 8:12693
Chorn, K.S., Revised draft installation standards for solar-energy systems, 8:12022 (R;US)
Chow, J., *See* Boland, W.R., 8:13553
Chrien, R.E., Physical basis for prompt-neutron activation analysis, 8:12749 (R;US)
Chrisman, B.L., *See* Sun, C.R., 8:13243
Christianson, L.L., *See* Mayer, G.G., 8:11701
Christman, P.G., Analysis of sulfur retention in fluidized-bed combustion, 8:11770 (RA;US)
Chrysostome, G., Pressurized oxygen blown fluidized bed gasification of wood, 8:11967 (RA;US)
Chu, M.S., Analysis of waste-package behavior for high-level waste, 8:11910 (R;US)
Chum, H.L., Electrochemistry applied to thermal conversion, 8:12092 (R;US)
Survey of the electrochemistry of some biomass-derived compounds, 8:12097 (R;US)
Chupp, T.E., *See* Norman, E.B., 8:13227
Chuvil'skij, Yu.M., *See* Smirnov, Yu.F., 8:13305
Chyssler, J., *See* Aittola, J.-P., 8:11912
Ciancanelli, E.V., Faulting and ore controls at the Culver-Baer mine, Sonoma County, California, 8:12196 (RA;US)
Ciliberti, D.F., Gas characterization from fluidized-bed coal gasification. Fourth quarterly report, June 1-August 31, 1982, 8:11627 (R;US)
Ciminesi, F.J., *See* Cohn, J.J., 8:11873
Clancy, B.E., ANAUSN - a one-dimensional multigroup SN transport theory module for the AUS reactor neutronics system, 8:12337 (R;AU)
Clarke, M.M., Human factors in Remote-Control-Engineering Task development activities. Consolidated Fuel-Reprocessing Program, 8:11820 (R;US)
Clarke, O., Alabama peat resources project, 8:11702 (RA;US)
Clarke, W.M., *See* Orvis, D.D., 8:11896
Clausing, A.M., *See* Rand, H.J., 8:12139
Clausing, R.E., *See* Jackson, G.L., 8:13479
Clayton, M., Commercial utility rate guide for SOLCOST Data Bank cities, 8:12635 (R;US)
Claytor, T.N., Measurement of acoustic background noise on the EBR-II steam generators, 8:12378 (J;US)
Cleaver, J.E., Measurement of unscheduled synthesis by autoradiography, 8:13132 (BA;US)
See Borek, C., 8:13113
Clegg, T.B., Application of the electron-cyclotron resonance source to Lamb-shift polarized ion sources, 8:13235 (R;US)
See Wilkerson, J.F., 8:12915
Clements, L.D., Development of an indirectly heated pyrolysis reactor, 8:11964 (RA;US)
Clemmer, R.G., *See* Misra, B., 8:13516
Clifford, C.E., *See* Micklich, B.J., 8:13518
Cline, C.F., Division of Materials Science (DMS) meeting presentation, 8:12742 (R;US)
Coakley, J.M., *See* Iyer, H.M., 8:12204
Coats, D.W. Jr., Damping in building structured during earthquakes: test data and modeling, 8:12854 (R;US)
Cobb, J.C., *See* Hower, J.C., 8:11669
Coble, C.G., *See* Engler, C.R., 8:12102
See Hiler, E.A., 8:12103
Cochran, H.D., New technologies in fossil-fuel utilization, 8:12491 (R;US)
Cochran, N.P., Synthetic fuels from coal: our moral equivalent of war, 8:11775 (RA;US)
Cocking, S.J., *See* Burch, S.F., 8:12876
Coffman, J.A., Steam gasification of biomass, 8:12070 (RA;US)
Cogburn, C.O., *See* Brandon, W.E., 8:12991
Coggiola, M.J., Collisional mechanisms in D^- beam sources for MFE experiments and reactors. Technical progress report, November 1, 1981-October 31, 1982, 8:13472 (R;US)
Coghlan, W.A., *See* Mansur, L.K., 8:12660
Cohen, A.D., State resource estimation: South Carolina, 8:11698 (RA;US)
See Vigerstad, T.J., 8:11714
Cohen, L., *See* Costello, F., 8:12367
Cohen, N., Estimation of the cumulative exposure to uranium mine atmospheres by in vivo measurements of lead-210 in the skull, 8:13401 (BA;US)
Cohen, S., *See* Jeppson, D.W., 8:13483
Cohen, S.A., Plasma surface interactions in controlled fusion devices. Report on the fifth international conference, Gatlinburg, Tennessee, United States of America, 3-7 May 1982, 8:13455 (J;AT)
Cohen, S.J., Exxon donor solvent coal liquefaction process: ECLP operating experience II, 8:11592 (RA;US)
Cohn, J.J., Comparative assessment of disposal of TRU waste in a greater-confinement disposal facility, 8:11873 (R;US)
Cohn, S.H., Applications of nuclear technologies for in-vivo elemental analysis, 8:13059 (R;US)
Cole, T.E., *See* Yue, D.D., 8:12415
Coleman, M.M., *See* Given, P.H., 8:11613
Coleman, S.D., *See* Solman, F.J., 8:12110
Colgate, S.A., Gamma bursts, 8:13231 (R;US)
Non-LTE astrophysics and the origin of high-energy cosmic rays, 8:13230 (R;US)
Colletti, J.P., Iterative solution to the optimal control of depletion problem in pressurized water reactors, 8:12310 (D;US)
Collins, G., *See* Hale, L.A., 8:12619
Collins, H.D., Acoustic-emission linear-pulse holography, 8:12881 (R;US)
Colmenares, C.A., *See* Vook, R.W., 8:12695
Colombant, D.G., *See* Emery, M.H., 8:13487
See Stamper, J.A., 8:13524
Colp, J.L., Final report - Magma Energy Research Project, 8:12248 (R;US)
Compere, A.L., *See* Googin, J.M., 8:12041
Concone, B.R.V., *See* Doin, P.A., 8:12038
See Senise, J.T., 8:12036
Conley, T.B., Techno-economic assessment on the utilization of surge-leg pumps in coal liquefaction, 8:11654 (R;US)
Conner, D.W., Studies of energy efficient advanced transport aircraft for beyond 1990, 8:12591 (RA;US)
Connolly, J.S., Role of porphyrins and chlorophylls in artificial photosynthesis, 8:12816 (R;US)

Conover, M.F., *See* Davis, R.J., 8:12183
Cook, J.H., Metallograph for the examination of low-level radioactive samples, 8:11948 (J;US)
Cook, K.V., Ultrasonic examination of JBK-75 strip material, 8:13493 (R;US)
Cook, N.G.W., Ground-water problems in open-pit and underground mines, 8:11740 (J;US)
Cook, V., *See* Bulos, F., 8:12897
Cook, W.A., Effect of geometric shape on two-dimensional finite elements, 8:12699 (J;NL)
Cooke, R.A., Energy impact of FAA regulations and operating procedures: an operator's viewpoint, 8:12605 (RA;US)
Cooper, A.L., *See* Emery, M.H., 8:13487
Cooper, R.K., Linac technology for free-electron lasers, 8:12865 (R;US)
Cooper, W.A., Neutral beam effects on tokamak ballooning mode stability, 8:13523 (J;GB)
Coover, H.W., Turn in the road: Eastman chemicals from coal, 8:11596 (RA;US)
Copa, W.M., Wet oxidation of peat, 8:11667 (RA;US)
Copeland, D., *See* Banks, C.E., 8:11826
Cords, D., *See* Bartel, W., 8:13256
Corey, J.C., Stack-released plutonium in the terrestrial environment of a chemical separations facility, 8:13067 (J;US)
Corino, E.R., Potential for commercial synthetic fuels in the US energy future, 8:12492 (RA;US)
Cornella, R.I., *See* Komoriya, H., 8:12376
Cornella, R.J., *See* Bretscher, M.M., 8:12375
Cornish, D.N., *See* Haubenreich, P.N., 8:13503
Cornwell, K.L., *See* Larsen, P.O., 8:13122
Cortez, D.H., Application of the Toscoal process to the electric utility industry, 8:12269 (RA;US)
Corvinus, D., *See* Cohen, A.D., 8:11698
Cosack, M., *See* Alberts, W.G., 8:12956
Cost, J.R., Direct spectrum-analysis method for obtaining the relaxation-time spectrum from relaxation-response data: amorphous metals, 8:12684 (R;US)
Costa, D.L., *See* Tice, R.R., 8:13188
Costa, J.B., Solar monitoring by Pacific Gas and Electric Company, 8:12149 (RA;US)
Costantini, L., *See* Argentesi, F., 8:11934, 8:11935
Costello, F., NRC TLD direct radiation monitoring network. Progress report, April-June 1982, 8:12367 (R;US)
Cottrell, W.B., General administrative activities, 8:12428 (J;US)
Coulson, L., *See* Gollon, P.J., 8:12999
Cousinou, G., *See* Arnal, T., 8:11865
Cousins, W.J., Oxygen-blown entrained-flow gasification of wood, 8:11966 (RA;US)
Coutant, C.C., Foreseeable effects of CO_2-induced climatic change: freshwater concerns, 8:13034 (J;CH)
Cowan, G.A., Solar neutrino production of technetium-97 and technetium-98, 8:13233 (J;US)
Cox, B., Dimuon production in hadronic interactions, 8:13258 (R;US)
Cox, C.H. III, *See* Branz, H.M., 8:12109
Craft, J.L., *See* Albert, D.M., 8:13185
Craig, G.N. II, *See* Ethridge, F.C., 8:11622
Crail, A.C., *See* Cheng, T.C., 8:12412
Cramer, J.G., *See* Lynch, W.G., 8:13344
Crase, K.W., β and γ-comparative dose estimates on Enewetak Atoll, 8:13400 (J;GB)
Crawford, P.C., Automated core-test experiment, 8:13016 (R;US)
Creel, L.R., *See* Horning, R.R., 8:13550
Cremeans, A.H., Thermal performance case studies for residential solar heating and cooling systems. Final report, 8:12165 (R;US)
Crispin, K., *See* Athey, C. III, 8:13567
Cronauer, D.C., Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Final progress report, February 1980-July 1982, 8:11628 (R;US)
Cronenberg, A.W., Assessment of fuel-foaming potential during core-meltdown accidents, 8:12414 (R;US)
Cronin, J.W., Consideration of a measurement of absolute value eta $_{00}$ ^{2}/absolute value eta/sub +-/^{2} at LAMPF II, 8:13264 (R;US)
Cronkite, E.P., *See* Garnett, H.M., 8:13120
Cross, W.G., Calculations on neutron dosimetry at the Chalk River Nuclear Laboratory, 8:13397 (RA;US)
See Ing, H., 8:13399
Cross, W.H., Anaerobic treatment of gasifier effluents. Quarterly report No. 5, 8:11684 (R;US)
Croucher, D.W., *See* Cronenberg, A.W., 8:12414
Crutchmer, J.A., *See* Ashcraft, R.W., 8:13010
Csorna, S.E., *See* Panvini, R.S., 8:13252
Culp, R.A., Personnel neutron dosimeter utilizing radiochromic dyes, 8:12976 (RA;US)
Culp, R.R., *See* Brandon, W.E., 8:12991
Cumerlato, C.L., *See* Van Eck, O.J., 8:13211
Cunningham, D.C., Computer codes: a bibliography, 8:13545 (R;US)
Computer codes: a bibliography, 8:13546 (R;US)
Cunningham, R.A. Jr., *See* Cook, K.V., 8:13493
Curtis, C.T., *See* Zahn, H.S., 8:13531
Curtis, G.H., *See* Donnelly-Nolan, J.M., 8:12190
Cushman, J.H., *See* Ranney, J.W., 8:12066
Czapski, G., Nature of oxygen-containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, July 1981-June 1982, 8:12820 (R;US)
See Samuni, A., 8:13180
Czarnecka-Nieminska, E., *See* Gadkowski, M., 8:12279

D

D'Agostini, G., *See* Behrend, H.J., 8:13255
D'Amore, M., *See* Massimilla, L., 8:11767
D'Eliscu, P.N., Biological impacts of alcohol fuel emission on selected pollinator, predatory and nutrient-cycling insects and arachnids, 8:13177 (RA;BR)
d'Enghien, E.B., Maintenance of 12C software and adaptation to the data available at DG XVII and national planning offices. Final report, 8:12481 (R;XE)
D'Oliveira, A.B., *See* do Amorim, E.S., 8:12361
Dabora, E.K., *See* Tozzi, L., 8:12645
Daffe, A., *See* Guilmot, J.F., 8:12461
Dahlgren, L., *See* Bodin, S., 8:12009
Dahlin, R.S., Baghouse performance and ash characterization at the Arapahoe Power Station, 8:12281 (R;US)
Dale, B.E., Methanol production from fermentor off-gases. Final report, July 1, 1981-June 30, 1982, 8:11972 (R;US)
Daly, T.A., Comparative performance of a 10-MW generic reactor with HEU and LEU fuels, 8:12373 (J;US)
Dameran, G., Pt. 3. Acid separation, 8:11886 (RA;XE;In German)
Pt. 2: Non-active laboratory for demonstrating the ILONA process. Construction and operating results, 8:11885 (RA;XE;In German)
Damm, C.C., *See* Doggett, J.N., 8:13530
Damon, E.G., Comparison of infrared analysis and in vitro dissolution results with clearance of inhaled uranium in rats exposed to yellowcake aerosols, 8:13154 (RA;US)
Retention and translocation of uranium following subcutaneous implantation in rats of yellowcake powder from two uranium mills, 8:13153 (RA;US)
See Eidson, A.F., 8:13155
Daniel, S.L., *See* Taylor, J.M., 8:11852
Daniels, S.W., Relaxation oscillations in a bounded magnetized plasma, 8:13457 (J;GB)
Danielson, L., *See* Saunders, M., 8:12519
David, E.E. Jr., Outlook for coal synthetics: time for re-appraisal and resolve, 8:11597 (RA;US)
David, J., Computer-aided dose determination and methods of occupational dose analysis using film, 8:13389 (RA;DE;In German)
Davidson, J.W., *See* Kunimoto, Y., 8:13521
Davidson, K.J., *See* Griffith, R.V., 8:12982
Davies, R.L., Makret place economics and coal conversions, 8:12268 (RA;US)
Davis, A., *See* Given, P.H., 8:11613
Davis, E., *See* Lloyd, W.G., 8:11672
Davis, H.T., *See* Puig, J.E., 8:11800
Davis, J., State resource estimation: Maine, 8:11694 (RA;US)
See Cameron, C.C., 8:11708
Davis, P.K., Flow and design characteristics of the hydrocyclone for the recovery of coal fines. Fifth quarterly report, September 1, 1982-November 30, 1982, 8:11754 (R;US)
Davis, R.H., Configurational testing of electron-beam ionization for coal-fly-ash precipitators. Quarterly report No. 5, December 2, 1981-March 1, 1982, 8:11685 (R;US)
Davis, R.J., Texas geothermal R D & D program planning support document. Final report, 8:12183 (R;US)
Davis, S., Transportation contingency planning, 8:12609 (RA;US)
Davis, S.N., Hydrogeology of radioactive waste isolation: the challenge of a rational assessment, 8:11918 (J;US)
Davis, W.E., Effect of using time-averaged precipitation for wet

removal in a Lagrangian assessment model, 8:13030 (R;US)
See Alkezweeny, A.J., 8:13036
Dawes, M.H., *See* Schnacke, A.W., 8:12524
Dawson, J.M., *See* Grisham, L.R., 8:13448
Dawson, L.R., *See* Fritz, I.J., 8:12741
See Osbourn, G.C., 8:13004
DayDay, N., PNESD proton nucleus elastic scattering data. Contents and documentation, 8:13296 (R;XA)
de Abreu, R.S., *See* Nanni, H., 8:12654
De Angelis, R.J., Structural characteristics of cobalt particles in a 9.5%Co-ZSM-5 catalyst. Semiannual report, May 18, 1982-November 18, 1982, 8:11639 (R;US)
De Bakker, P., *See* Ludlow, J., 8:11728
de Bony, Y., *See* Brillant, M., 8:12704
De Bruin, R.H., *See* Ver Ploeg, A.J., 8:11791
de Mattos Silvares, O., *See* de Oliveira, S. Jr., 8:12040
de O. Borba, M.L., *See* Nanni, H., 8:12654
de Oliveira, S. Jr., Use vegetable oils in internal combustion engines, 8:12040 (RA;BR)
de Souza, J.A.L., Oil refining flexibility and alternative fuels, 8:11807 (RA;BR)
DeAngelis, D.L., Introduction to modeling fish migratory behavior, 8:13102 (R;US)
Model of naticid gastropod predator-prey coevolution, 8:13073 (R;US)
Decoste, R., *See* Stamper, J.A., 8:13524
Dean, J.R., Analytical comparison of Boron and cadmium absorbers in research reactors, 8:12374 (J;US)
Deffenbaugh, D.M., *See* Treat, C.H., 8:12169
Deiss, S.R., Software for managing multicrate FASTBUS Systems, 8:13565 (R;US)
Del Duca, T., *See* Quam, W., 8:12980
Del Grande, N.K., Airborne-temperature-survey maps of heat-flow anomalies for exploration geology, 8:12202 (R;US)
Delaunay, M., *See* Clegg, T.B., 8:13235
DeMerschman, A.W., Safeguards through secure automated fabrication, 8:11937 (R;US)
Demerson, E.L., *See* Foster, P.A., 8:13009
Denisov, Yu.N., *See* Glazov, A.A., 8:12895
Denlinger, R.P., Seismic-reflection investigations at Castle Rock Springs in the Geysers geothermal area, 8:12205 (RA;US)
deRiel, S.R., *See* Levy, P.F., 8:11668
Derkach, A.Ya., System for measuring of proton polarization in polarized target, 8:12924 (R;SU;In Russian)
Deryuga, V.A., *See* Vdovin, A.I., 8:13325
Deshpande, G.V., Use of supercritical water for extraction of low rank coals, 8:11634 (RA;US)
See Holder, G.D., 8:11633
Deshpande, S.D., *See* Bishop, A.A., 8:11638
Desille, H., *See* Arnal, T., 8:11865
Dethmers, J.K., *See* Shelnutt, J.A., 8:12812
Deutsch, R., Plasmafocus, 8:13428 (RA;DE;In German)
Plasmafocus, 8:13484 (RA;DE;In German)
Deutsch, W.J., Solubility equilibria in basalt aquifers: the Columbia Plateau, Eastern Washington, USA, 8:11916 (J;NL)
Devaney, H.E., *See* Morgan, M.T., 8:11866
DeVore, T., *See* Quam, W., 8:12980
Dewar, R.L., *See* Tang, W.M., 8:13508
Dewart, J.M., *See* Bowen, B.M., 8:13043
DeWinkel, C.C., An assessment of wind characteristics and wind energy conversion systems for electric utilities, 8:12259 (R;US)
Dhawan, S., *See* Howell, R.H., 8:12934
Di Muro, N., *See* Massimilla, L., 8:11767
Di Salvo, E., Surface waves in α-nuclei elastic scattering, 8:13303 (R;IT)
Diamond, D.J., Importance of spatial kinetics in LWR safety analysis, 8:12444 (J;US)
Dias, M.S., Activity determination by a 4π-γ well-type ionization chamber, 8:12967 (R;BR)
See Lameiras, F.S., 8:12358
Diaz-Bossio, L.M., Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen, 8:12787 (R;US)
Dibble, R.W., *See* Driscoll, J.F., 8:12833
Dickerson, L.S., *See* Johnson, J.K., 8:11655, 8:11656
Dickerson, M., *See* Gudiksen, P., 8:13196
Dickman, P.T., *See* Cohn, J.J., 8:11873
Dickson, J.C., Impacts of alternative-engine technology on the refining industry, 8:11809 (R;US)
Didocha, R.J., Peat resource estimation in Georgia, 8:11705 (RA;US)
Diegle, R.B., *See* Ruppen, J.A., 8:12688
Diehl, K.C., *See* Engler, C.R., 8:12102
Dietze, G., *See* Alberts, W.G., 8:12956
Difiglio, C., *See* Davis, S., 8:12609
Dillon, W.E., *See* Fitzer, J., 8:12111
Dimitrelis, D., Thermodynamic properties of strongly nonideal fluid mixtures from an extended quasi-chemical theory, 8:12792 (R;US)
DiNardo, P.E., *See* Wasan, D.T, 8:11805
Diner, B.A., *See* Joliot, P., 8:13127
Dini, J.W., Coating Processes Group progress report, September-October 1982, 8:12690 (R;US)
DiPuccio, *See* Walsh, J., 8:11959
Dittmann, P., *See* Bartel, W., 8:13256
Dmitrievskij, V.P., *See* Glazov, A.A., 8:12895
do Amorim, E.S., Sensitivity of control times in function of core parameters and oscillations control in thermal nuclear systems, 8:12361 (R;BR;In Portuguese)
Dobie, M.J., Residual strain and strength loss in filament wound circular rings. Final report, October 13, 1980-September 30, 1981, 8:12720 (R;US)
Dodel, G., *See* Salzmann, H., 8:13427, 8:13432
Doggett, J.N., Tandem mirror next step-remote maintenance, 8:13530 (J;US)
Dogliani, H.O., *See* Wadlinger, E.A., 8:12906
Dogniaux, R.A., Spectral measurements of solar radiation at the Royal Meteorological Institute of Belgium, 8:12004 (RA;CH)
Dohlman, H.G., *See* Albert, D.M., 8:13185
Doin, P.A., Analysis of possible yield improvement in the industrial processing of sugarcane to alcohol, 8:12038 (RA;BR)
See Senise, J.T., 8:12036
Dokuzoguz, H.Z., KBW: improvements on a well-known process, 8:11586 (RA;US)
Dole, L.R., *See* Morgan, M.T., 8:11866
Doll, M.A., *See* Horning, R.R., 8:13550
Dolya, S.N., Structure of transition radiation of the electron bunch moving through plane screens, 8:13377 (R;SU;In Russian)
Doman, D.R., Design guides for radioactive material handling facilities and equipment, 8:12862 (J;US)
Domingo, N., Condensation of Refrigerant-11 on the outside of horizontal and inclined enhanced tubes, 8:12241 (R;US)
Domokos, G., Research in theoretical physics. Annual progress report, April 1, 1982-March 31, 1983, 8:13286 (R;US)
Domschke, A.G., *See* Nanni, H., 8:12654
Donaldson, E.C., Microbial enhancement of oil recovery, 8:11794 (RA;US)
Donath, E.E., Synthetic fuels industry in Germany 1927 to 1945, 8:11778 (RA;US)
Dondi, M.G., *See* Argentesi, F., 8:11934, 8:11935
Donnelly-Nolan, J.M., Geochronology and evolution of the Clear Lake Volcanics, 8:12190 (RA;US)
See Futa, K., 8:12191
See Hearn, B.C. Jr., 8:12189
See Mankinen, E.A., 8:12192
See McLaughlin, R.J., 8:12187
See Thompson, J.M., 8:12209
Donsi, G., *See* Massimilla, L., 8:11767
Doran, J.C., *See* Horst, T.W., 8:13023
Dorfan, J., Recent results from the MAC and MARK II detectors at PEP, 8:12932 (R;US)
Dorner, L.F., *See* Semelr, B.L., 8:13108
Dorner, R., Attenuation of photon beams from radionuclides. Pt. 6, 8:13373 (R;DE;In German)
Doss, J.D., LENS* 4: a program for calculation of geometric optics of the human eye, 8:13136 (R;US)
Dostal, M., *See* Brown, T., 8:12158
Doughterty, R.P., Superconductivity and low-temperature phases of Cu/sub x/Mo_6Se_8, 8:12738 (R;US)
Douglas, J., Ensuring power-system stability, 8:12286 (J;US)
Douglas, N., *See* Salzmann, H., 8:13432
Douglass, S.S., Control-systems improvements in a precision coordinate measuring machine, 8:12857 (R;US)
Dovbenko, A.G., Direct process contribution into the hard component of the ^{113}In(n,n') reaction spectra, 8:13324 (RA;SU;In Russian)
Dowell, F., Simple EOS for branched (low-density) polyethylene, 8:12723 (R;US)
Simple EOS for linear (high-density) polyethylene (Marlex), 8:12724 (R;US)
Doyle, B.L., Sandia nuclear microprobe, 8:12931 (R;US)
Doyle, T.E., *See* King, J.J., 8:13209
Drake, R.E., *See* Donnelly-Nolan, J.M., 8:12190
Draper, J.V., *See* Clarke, M.M., 8:11820
Dreicer, M., On-line liquid-effluent monitoring of sewage at Lawrence

Livermore National Laboratory, 8:13092 (R;US)
Dreyer, N.A., *See* Kohn, H.I., 8:13140
Driscoll, J.F., Mass fluxes anti rho' anti u' and anti rho' anti nu' measured in a turbulent nonpremixed flame, 8:12833 (RA;US)
Drury, J.S., Literature survey, 8:13085 (RA;US)
Methods of removing uranium from drinking water. I. A literature survey. II. Present municipal water treatment and potential removal methods, 8:13084 (R;US)
Drysdale, J.A., *See* Lyons, J.A., 8:13210
Du Bois, P., *See* Athey, C. III, 8:13567
Duba, J.G., Airlines and fuel conservation: doing more with less, 8:12606 (RA;US)
Dubbe, D.R., *See* Pratt, D.C., 8:12095
Duckworth, W.H., *See* Rosenfield, A.R., 8:12705
Duda, J.L., *See* Liauh, W.C., 8:11804
Duda, L.E., *See* Muller, A.B., 8:11909
Duerksen, J.H., *See* Blevins, T.R., 8:11793
Duffey, T.A., *See* Lamoreaux, G.H., 8:11861
Duftschmid, K.E., Occupational radiation exposure in Austria - results of personnel monitoring using thermoluminescent dosemeters, 8:13388 (RA;DE;In German)
Duke, W.L., Regrinding and relapping of single-point, single-crystal diamond turning and boring tools, 8:12856 (R;US)
Dumarchez, P., SAMSS: computer-aid system for the preparation of social-science models. Final report, 8:13098 (R;XE)
See Brunet, C., 8:13097
Dumka, B.R., Comparison of Ontario Hydro's performance with world power reactors, 1981, 8:12475 (R;CA)
Duncan, C.C., *See* Lambrecht, R.M., 8:13129
Duncan, D.A., *See* Paganessi, J.E., 8:11602
Dunegan, H.C., *See* Stradley, N.H., 8:12717
Dunlap, R.M., Heat driven heat pump using paired ammoniated salts, 8:12581 (P;US)
Dunlavy, D.J., *See* Ahrenkiel, R.K., 8:12744
Dunn, J.R., Demonstration of a low-cost, indirect evaporative cooling system. Final report, 8:12568 (R;US)
Design evaluation of an improved indirect evaporative cooling system. Final report, 8:12576 (R;US)
Durham, W.B., *See* Mirkovich, V.V., 8:13221
Durieu, L., Erigone bus study, 8:13543 (R;XC)
Duscha, R.A., *See* Woods, R.R., 8:12541
Dutt, D.S., Improved specifications for fast reactor fuel, 8:12370 (R;US)
Dutzi, E.J., Advanced Coal-Extraction-Systems Project: report of activities for fiscal year 1980-1981, 8:11716 (R;US)
Dyer, C.W., *See* Poutsma, M.L., 8:11665
Dyer, F.F., Determination of uranium and thorium in semiconductor memory materials by high fluence neutron activation analysis, 8:12766 (J;CH)
Dzhelepov, V.P., *See* Glazov, A.A., 8:12895
Dzyublik, A.Ya., Radio-frequency resonance effect on diffraction of Moessbauer gamma quanta in a crystal, 8:12671 (RA;SU;In Russian)

E

Eadie, W.J., *See* Davis, W.E., 8:13030
Easson, S.A., *See* Wheeler, F.J., 8:12339
Easter, R.C., Interpretations of the OSCAR data for reactive-gas scavenging, 8:13024 (R;US)
See Alkezweeny, A.J., 8:13036
Eastman, J.A., On the mechanisms that control vertical ozone flux to vegetative surfaces, 8:13035 (BA;US)
Eatman, G.H., Transportation of coal by slurry pipelines, 8:11745 (RA;US)
Eaton, R.R., Influence of convective-energy transfer on calculated temperature distributions in proposed hard-rock nuclear waste repositories, 8:11917 (J;US)
Ebner, W.B., Lithium-sulfur dioxide (Li/SO_2) battery safety hazards - thermal studies. Final report 24 Dec 80-5 Mar 82, 8:12457 (R;US)
Echer, C.J., *See* Gourdin, W.H., 8:12716
Edelstein, N., Thermodynamic properties of chemical species in nuclear waste, 8:12825 (R;US)
Eder, J.S., *See* Moreland, W.C., 8:12621
Edgar, T.F., *See* Christman, P.G., 8:11770
Edison, A.F., *See* Damon, E.G., 8:13153
Efimov, A.D., Taking into account proton-neutron symmetry in the framework of interacting boson model, 8:13367 (RA;SU;In Russian)
Egan, P.O., *See* Howell, R.H., 8:12934
Eggers, R.F., Loss detection and alarm resolution in processing special nuclear material, 8:11941 (R;US)
Ehriksonas, K.M., *See* Vanagas, V.V., 8:13363
Ehrlich, S., *See* McGowin, C.R., 8:11768
Eichler, R., *See* Bartel, W., 8:13256
Eichten, E., Comment on tumbling gauge theories, 8:13291 (J;NL)
Eidson, A.F., Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982, 8:11928 (R;US)
Two-year dose pattern studies of inhaled yellowcake in the Beagle dog, 8:13155 (RA;US)
Use of air sampling data from uranium mills to estimate respiratory tract deposition rates for inhaled yellowcake, 8:11929 (RA;US)
Use of in vitro dissolution data when interpreting uranium bioassay data, 8:11930 (RA;US)
See Damon, E.G., 8:13154
Eimerl, D., *See* Carder, B., 8:12448
Einstein, H.E., *See* Malachesky, P.A., 8:12651
Eisen, Y., Wide energy range Rem response personnel neutron dosimeter, 8:12985 (RA;US)
Eisenbud, M., *See* Cohen, N., 8:13401
Eisenhauer, C.M., Analysis of neutron room return, 8:13398 (RA;US)
See Schwartz, R.B., 8:13396
Ejima, S., *See* Jackson, G.L., 8:13479
See Jahns, G.L., 8:13506
Ekberg, E.L., *See* Grisham, D.L., 8:12443
Elder, J.C., *See* Graf, J.M., 8:11927
Eldridge, J.S., *See* Alexander, W.A., 8:13066
Elet, R.S., ICRF antenna coupling studies, 8:13478 (R;US)
Elias, N.Y., *See* Henein, N.A., 8:11814
Eliezer, Z., *See* Brennan, M., 8:13470
Elioff, T., *See* Alonso, J.R., 8:12925
Ellingson, A.C., Approach to E, S, and H assurance programs for institutions. Volume II. Line-organization functions, 8:12469 (R;US)
Elliott, D.C., Bench scale research in biomass direct liquefaction, 8:12082 (RA;US)
Elliott, D.G., Tests of a two-stage, axial-flow, two-phase turbine, 8:12240 (R;US)
Elliott, D.L., World-wide wind energy resource assessment, 8:12256 (RA;CH)
Ellis, F., *See* Gordon, R.G., 8:12094
Ellis, J., *See* Sarma, K.R., 8:12098
Ellis, K.J., *See* Cohn, S.H., 8:13059
Ellis, R.E., *See* Kershner, C.J., 8:13486
Ellis, R.H., BART's energy consumption and costs: a comparative analysis, 8:12599 (RA;US)
Ellis, S.D., Summing logs: the saga continues....., 8:13288 (R;US)
Elmaleh, D.R., *See* Levy, S., 8:12826
Elston, L.W., *See* Knight, J.A., 8:12075
Elthon, T.E., *See* Stewart, C.R., 8:13126
Elton, J., *See* Oesterreicher, H., 8:12697
Emerson, L.C., *See* Jackson, G.L., 8:13479
Emery, J.F., *See* Dyer, F.F., 8:12766
Emery, M.H., Stability and symmetry in inertial-confinement fusion, 8:13487 (R;US)
Endres, G.W.R., *See* Yoder, R.C., 8:13395
Endsley, R., Improving divider calibration techniques, 8:12888 (R;US)
Eng Kie Souw, Investigation of transport processes in the wall zone of helium plasma by means of spectroscopical methods, 8:13434 (R;DE;In German)
Engelhard, M., Particular aspects and limits of absolute nuclear liability, 8:12401 (R;ES;In French)
Engelking, P.C., Laser spectroscopy of combustion intermediates, 8:12829 (R;US)
England, G., Soot formation in synthetic-fuel droplets. Eighth quarterly technical progress report, July 1-September 30, 1982, 8:11961 (R;US)
Engler, C.R., Economic and engineering evaluation of plant oils as a diesel fuel. Final report, 8:12102 (R;US)
Ensminger, J.T., *See* Drury, J.S., 8:13084, 8:13085
Eppel, D., Numerical solution of partial differential equations of physics. Pt. 2, 8:13415 (R;DE;In German)
Epperly, W.R., EDS coal liquefaction process development. Phase V. ECLP industrial hygiene program. Interim report, 8:11599 (R;US)
Eppley, R.W., *See* Heaney, S.I., 8:13079
Erckmann, V., *See* Wilhelm, R., 8:13426, 8:13431
Erz, U., *See* McCarthy, A.L., 8:13430
See Raeuchle, E., 8:13425
Espinosa, G., Evaluation of a commercial, semi-automatic system for counting

tracks in solid state nuclear detectors used for personnel dosimetry, 8:12983 (RA;US)
Estabrook, K.G., *See* Kruer, W.L., 8:13526
Ethridge, F.C., Overburden characterization and post-burn study of the Hoe Creek, Wyoming underground coal gasification site and comparison with the Hanna, Wyoming site, 8:11622 (R;US)
Evans, A.E. Jr., Energy dependence of the response of a ^{3}He long counter, 8:12998 (J;NL)
Evans, T.J., *See* Madison, F.W., 8:11715
Extermann, R.C., Cryogenic ionization chamber for high-resolution fission cross-section measurements, 8:13001 (J;NL)
Ezzat-Khalifa, H., Solar/gas Rankine/Rankine-cycle heat pump assessment. Final report Mar 81-Jul 82, 8:12164 (R;US)

F

Faerber, K., Current state in the establishment of a central personal dose registry, 8:13391 (RA;DE;In German)
Faermann, S., *See* Eisen, Y., 8:12985
Fager, J.E., *See* Brauer, F.P., 8:12770
Fairchild, P.D., *See* Intemann, P.R., 8:12557
Falco, C.M., *See* Schuller, I.K., 8:12700
Falconer, J.L., Catalyzed gasification of coal: isotope and XPS studies, 8:11644 (R;US)
Falk, R.B., *See* Tyree, W.H., 8:12990
Faller, T.H., *See* Van Eck, O.J., 8:13211
Fallon, P., *See* Steinberg, M., 8:12078
Faltens, A., *See* Cooper, R.K., 8:12865
Fang, J.M., Issues in federal preemption of state appliance energy-efficiency regulations, 8:12565 (R;US)
Fang, Q.T., *See* Miley, G.H., 8:13522
Fanous, F.S., Simplified analysis of shells with local, impulsive loads, 8:12402 (R;US)
Farber, M.G., Pilot solid-waste incinerator, 8:11877 (R;US)
Fardeau, *See* Guidez, J., 8:12349
Farrell, J.A., *See* Wadlinger, E.A., 8:12906
Farson, D.A., *See* Hall, H.G., 8:13119
Fassbender, A.G., Energy efficient industrial technology in Europe: a compendium. Interim report May 79-Feb 82, 8:12625 (R;US)
Faucher, B., *See* Bussiere, J.F., 8:12659
Faust, L.G., DOE Neutron Dosimetry Upgrade Program, 8:13394 (RA;US)
Faya, S.C.S., Introduction to current modeling techniques in nuclear fuel performance analysis, 8:12356 (R;BR)
Survey on fuel pellet cracking and healing phenomena in reactor operation, 8:12357 (R;BR)
Fayans, S.A., *See* Tolokonnikov, S.V., 8:13358
Fayeton, J.A., Multicoincidence techniques in atomic physics, 8:13244 (BA;NL)
Fedoseev, A.I., *See* Balbekov, V.I., 8:12847
Fehler, M., Observations of volcanic tremor at Mt. St. Helens volcano, 8:13206 (R;US)
Feijoo, R.A., *See* Muller, A., 8:12853
Feinberg, F., *See* Eichten, E., 8:13291
Fejer, A.A., Coal-fired combined-cycle power generating plants of the future, 8:12280 (BA;US)
Feldman, G., *See* Snover, K.A., 8:13316
Feldman, J.A., High performance liquid chromatographic group-type analysis of the product of Fischer-Tropsch synthesis. Final report, 8:12751 (R;US)
Feldmann, H.F., Gasification of forest residues in a high-throughput gasifier, 8:12071 (RA;US)
Felker, D.L., Study of the electrowinning of copper using a fluidized-bed electrochemical reactor, 8:12679 (R;US)
Felst, R., *See* Bartel, W., 8:13256
Fenner, H., *See* Behrend, H.J., 8:13255
Ferin, J., Pulmonary alveolar pores and alveolar macrophage-mediated particle clearance, 8:13137 (J;US)
Ferm, J.C., Study of the United States coal resources, 8:11717 (R;US)
See Hower, J.C., 8:11669
Fernandez y Fernandez, E., State of art of the methods for thermohydraulics design of LMFBR fuel elements, 8:12318 (R;BR;In Portuguese)
See Ballve, H., 8:12316
See Carajilescov, P., 8:12317
Ferrante, M.J., *See* Bennington, K.O., 8:13215
Ferraro, R.J., EPRI/TVA pilot electric-vehicle demonstration: update 1980, 8:12649 (R;US)
Ferreira, A., *See* Antonsen, T.M. Jr., 8:13460
See Chang, G.C., 8:12450
Ferreira, L.J., *See* Serra, C.E., 8:12037
Ferreira, M.A., *See* Rosenstock, H.M., 8:12809
Fessenden, R.W., *See* Madden, K.P., 8:12822
Fetters, G.D., Experimental study of heat transfer through coal-ash deposits, 8:11680 (J;US)
Field, J.H., *See* Behrend, H.J., 8:13255
Fields, G.L., Binderless briquetting of coal powders by an acetone treatment process, 8:11757 (R;US)
Figner, M., *See* Vdovin, A.I., 8:13325
Filatenkov, A.A., *See* Blinov, M.V., 8:13352
Filippo, J.S. Jr., *See* Krusic, P.J., 8:12799
Filippov, G.F., Algebraic version of resonating-group method and elastic scattering plases of the ^{3}He(n, n)^{3}He, ^{3}H(p, p)^{3}H, ^{3}H(d, d)^{3}H, 8:13299 (RA;SU;In Russian)
Generating invariants of Sp(6, R) model, 8:13362 (RA;SU;In Russian)
See Badalov, S.A., 8:13306
Filla, M., *See* Massimilla, L., 8:11767
Findley, G.L., *See* Hochmann, P., 8:13246
Findley, M.E., *See* Flanigan, V.J., 8:12073
Finholt, J.E., *See* Brown, G.M., 8:12795
Finn, H.F., UNSPEC reference manual: 10/29/82 version, 8:13379 (R;US)
Finn, P.A., Tritium control for the DEMO liquid-metal blanket design, 8:13517 (J;US)
Finston, H.L., *See* Parekh, P.P., 8:12769
Fiorenza, R., *See* Gudiksen, P., 8:13196
Firestone, R.F., *See* Yurkewycz, R., 8:11651
Fisch, N.J., Reply to Comments by W.N. Hugrass on the paper by N.J. Fisch, T. Watanabe "Field reversal by rotating waves" (Nucl. Fusion 22 (1982) 423), 8:13454 (J;AT)
Fisenne, I.M., *See* Harley, N.H., 8:13171
Fisher, J.L., *See* Chang, F.R., 8:13504
Fisher, W.A., Numerical modeling of a fast-neutron collimator for the Alcator A fusion device, 8:13474 (R;US)
Fishman, H., *See* Kaplan, E., 8:13133
Fitzer, J., Impact of residential utility-interactive PV-power systems on the utility, 8:12111 (R;US)
Fitzgerald, J.M., Discrete frequency noise and its reduction in small axial-flow fans. Technical memo, 8:12836 (R;US)
Fjeldsted, J.C., *See* Jackson, W.P., 8:12750
Flaim, S., *See* Hertzmark, D., 8:12035
Flanigan, V.J., System design for wood gasification using internal heating, 8:12073 (RA;US)
Fleming, D.K., Electricity generation from coal using fuel cells: preliminary systems analysis, 8:12537 (BA;US)
Flemings, M.C., Continuous production of strip by Rheocasting. Final report, August 16, 1978-September 30, 1981, 8:12663 (R;US)
Flener, W.A., Strategies for saving airline fuel, 8:12607 (RA;US)
Fletcher, J.G., LINCS: Livermore's network architecture, 8:13568 (R;US)
Flowers, R.H., Objectives for radioactive waste packaging, 8:11863 (R;GB)
Flumerfelt, R.W., Magnitude and role of dynamic interfacial effects in low tension flooding, 8:11806 (J;US)
Fluss, M.J., *See* Rothman, S.J., 8:12694
Fock, J.H., *See* Lau, H.J., 8:12732
Fodor, R.J., Great Plains Gasification Associates project: the nation's first commercial synthetic fuels plant, 8:11649 (RA;US)
Foessel, P., Analysis of the spectrometer SPES 4 and study of an associated detection apparatus, 8:12927 (R;FR;In French)
Fogle, G.L., *See* Rothman, S.J., 8:12694
Fong, A., Characterization of large diameter silicon by low-bias charge collection analysis in Si(Li) pin diodes, 8:12997 (J;NL)
Fong, S., *See* Vanderlaan, M., 8:13112
Fontana, Xavier, Synthesis and simulation of corrector filter used for local measurement in PWR core from gamma thermometer signal, 8:12300 (R;FR;In French)
Ford, J.R., *See* Boland, W.R., 8:13553
Ford, P.C., *See* Walker, H.W., 8:12798
Ford, W., Applying the MRV11-C board, 8:13552 (R;US)
Ford, W.T., Physics with the MAC detector, 8:12940 (R;US)
Formwalt, W.A., A methodology for determining building heating system changeover timing. Master's thesis, 8:12552 (R;US)
Forney, R.H., Conversion of an industrial boiler to Coal-Oil Mixture, 8:11761 (RA;US)
Fort, T. Jr., *See* Miller, C.A., 8:11801
Forte, T.M., *See* Hunter, J.A., 8:13109
Foster, J.P., Enhanced irradiation creep deformation due to gradual temperature reductions, 8:12359 (J;NL)

Foster, P.A., Effect of thermal aging on the thermal stability and friction sensitivity of explosives, 8:13009 (R;US)
Foster, R.B., Outlook for fuel supplies for fuel cells, 8:12536 (BA;US)
Frame, P.W., Supplemental stack-effluent monitoring at the Safety Light Corporation, Bloomsburg, Pennsylvania. Final report, 8:13037 (R;US)
Frank, B., *See* Katzen, R., 8:11968
Frank, M.E., Chem Systems' Liquid Phase Methanol process, 8:11985 (RA;US)
Frank, M.V., *See* Orvis, D.D., 8:11896
Frankie, K.A., *See* Hower, J.C., 8:11669
Franklin, M., *See* Argentesi, F., 8:11934, 8:11935
Fraser, C.B., *See* Kuehn, K., 8:13190
Fraser, G., *See* Luykx, F., 8:12368
Frazer, J.W., *See* Herget, C.J., 8:12793
Frederick, F.P., *See* Dickson, J.C., 8:11809
Freed, E.J., SRL incinerator components test facility, 8:11876 (R;US)
Freel, J., SRC-II product applications - recent developments, 8:11595 (RA;US)
Freeman, R.R., *See* McIlrath, T.J., 8:13245
Fried, H.M., Green's functions at zero viscosity, 8:13247 (R;US)
Friedman, A.M., *See* Kaplan, E., 8:13133
Friedman, J., Peat gasification: Rockwell international process, 8:11601 (RA;US)
Friedman, M., Deformation mechanisms in granodiorite at effective pressures to 100 MPa and temperatures to partial melting, 8:13217 (R;US)
Friend, C.M., *See* Tsai, M.C., 8:12810
Fritts, M.J., *See* Emery, M.H., 8:13487
Fritz, L.J., Doping and transport studies in In/sub x/Ga/sub 1-x/As/GaAs strained-layer superlattices, 8:12741 (R;US)
Fritz, P., Heat transfer and fragmentation during contact between a gas-covered melt and cooling liquid, 8:12386 (R;DE;GE)
Fuchel, K., Introduction to the Central Scientific Computing Facilities, 8:13539 (R;US)
Fuelle, R., *See* Hohmuth, K., 8:12472
Fujita, Y., *See* Snover, K.A., 8:13316
Fujiwara, M., *See* Snover, K.A., 8:13316
Fuller, G.M., Replacement of large torus shield sectors in ETF with remote techniques, 8:13529 (J;US)
Fuller, R., *See* Bolkcom, J., 8:12156
Furman, C.R., *See* Ferraro, R.J., 8:12649
Furman, V.I., *See* Vakhtel', V.M., 8:13345
Futa, K., Strontium isotopes in the Clear Lake Volcanics, 8:12191 (RA;US)

G

Gadkowski, M., Environmental evaluation of European power plant cooling systems: a polish research project, 8:12279 (R;US)
Gaertner, M., *See* LaVake, J.C., 8:12303
Gage, S.J., Packaged plants, 8:11986 (RA;US)
Gaggioli, R., Concentration cells for combustion improvement. Final report on reaction rate in a zirconium-yttria solid-electrolyte fuel cell, 8:12521 (R;US)
Gale, J.E., Assessing the permeability characteristics of fractured rock, 8:13203 (J;US)
Gallaher, R.B., *See* Mays, G.T., 8:12426
Gallegos, A.F., *See* Wenzel, W.J., 8:13065
Galluzzo, N.G., *See* Levy, S.L., 8:12546
Galvao, O.B., *See* do Amorim, E.S., 8:12361
Gannon, E., *See* McBreen, J., 8:12458
Garcia, A. III, Development of metallization process, FSA project, cell and module formation research area. Quarterly technical report for the period ending September 30, 1982, 8:12049 (R;US)
Gardes, D., Parallel plate detectors, 8:12969 (R;FR;In French)
Gardner, J.H., *See* Emery, M.H., 8:13487
Gareis, G.E., Fabrication, interfacing, and testing of a special-purpose power-system simulator. Topical report, October 3-December 31, 1982, 8:12285 (R;US)
Garey, M.P., *See* Kahn, D.R., 8:11610
Garner, F.A., *See* Ghoniem, N.M., 8:12661
Garner, J.K., A high-temperature fusion blanket for synfuel and electrical production, 8:13519 (J;US)
Garner, L.J., *See* Higgins, R.S., 8:11723
Garnett, H.M., Regulation of the colony-stimulating activity produced by a murine marrow-derived cell line (H-1), 8:13120 (J;US)
Garren, A., *See* Alonso, J.R., 8:12925
Garrison, M., Passive-solar homes for Texas, 8:12173 (R;US)
Garrison, W., *See* Phillips, S.L., 8:12252
Gartling, D.K., COYOTE: a finite-element computer program for nonlinear heat-conduction problems, 8:12870 (R;US)
Garver, E.G., *See* Pratt, D.C., 8:12095
Gates, B.C., Kinetics and mechanism of desulfurization and denitrogenation of coal-derived liquids. Final report, June 1975-January 1979, 8:11612 (R;US)
Kinetics and mechanism of catalytic hydroprocessing of components of coal-derived liquids. Thirteenth quarterly report, May 16-August 15, 1982, 8:11619 (R;US)
Gates, T.E., Consolidation theory and its applicability to the dewatering and covering of uranium-mill tailings, 8:11924 (R;US)
Gavalas, G.R., Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R;US)
Gazzaly, M.M., *See* Geaga, J.V., 8:13313
Geaga, J.V., $C(\alpha,X)^{11}C$ cross sections at 1.59 and 4.19 GeV, 8:13313 (J;NL)
Gee, G.W., *See* Mayer, D.W., 8:11922
Gee, S.L., *See* Larsen, P.O., 8:13122
Gehri, D.C., Coyote FGC system: a status report on a spray dryer/baghouse combination, 8:11686 (RA;US)
Geissler, E., Documentation of initial activities in AGF long-term planning of R+D projects, 8:12479 (R;DE;In German)
Gelfer, B., *See* Mankinen, G.W., 8:11727
Geller, R., *See* Clegg, T.B., 8:13235
Gent, M.R., *See* Keelin, T.W., 8:12505
Gerald, J.D., *See* Garner, J.K., 8:13519
Geraldo, L.P., *See* Cesar, M.F., 8:12965
Gerdin, G., *See* Stygar, W., 8:13502
Geres, M., *See* White, A.L., 8:12637
Gergans, G.A., *See* Kaplan, E., 8:13133
Gersh, Kh.U., Three-particle decay of the 14^+ resonance with 19.7 MeV energy excited in the $^{16}O+^{12}C$ reaction, 8:13309 (RA;SU;In Russian)
Gerward, L., *See* Staun Olsen, J., 8:12778
Ghezelayagh, H., Micro-macropore model for sorption of water on silica gel in a dehumidifier, 8:12175 (J;GB)
Ghoniem, N.M., Hardening of irradiated alloys due to the simultaneous formation of vacancy and interstitial loops, 8:12661 (R;US)
Giabbai, M., *See* Cross, W.H., 8:11684
Giarda, L., Process of deposition of silicon single-crystal bars directly from the vapour phase, 8:12060 (R;LU)
Gibbins, J.R., *See* Wilson, H.T., 8:11990
Gibbs, A.G., Perturbation method for stochastic operator difference equations, 8:13558 (R;US)
Gibert, *See* Guidez, J., 8:12349
Gibson, W.M., *See* Sun, C.R., 8:13243
Gidaspow, D., *See* Ghezelayagh, H., 8:12175
Gilchrist, R.L., *See* Munson, L.F., 8:13049
Gillham, R.W., Contaminant migration in saturated unconsolidated geologic deposits, 8:13200 (J;US)
Gilligan, J.G., *See* Miley, G.H., 8:13522
Gillis, E.A., Fuel cells for electric utility applications, 8:12539 (BA;US)
Gilmore, E.H., Use of wind power to assist in stripper (oil) well pumping, 8:12265 (R;US)
Gindler, J.E., *See* Kaplan, E., 8:13133
Gionnoni, V.T., *See* Katzen, R., 8:11968
Giordano, R.M., Interfacial effects upon displacement in sinusoidal capillaries, 8:11803 (J;US)
Girard, *See* Guidez, J., 8:12349
Given, P.H., Relation of coal characteristics to liquefaction behavior. Final technical report, July 1976 to February 1981. Part III. Mechanistic studies, product distributions and supportive analytical investigations , 8:11613 (R;US)
Givens, E.N., *See* Ying, D.H.S., 8:11616
Gjerde, H.B., Kinetic studies of organocobalt compounds related to vitamin B_{12} coenzymes, 8:12786 (R;US)
Gladney, E.S., Quality assurance for environmental analytical chemistry at Los Alamos, 8:13028 (R;US)
Glaser, W., *See* Hein, K.R.G., 8:12283
Glass, R.S., *See* Ruppen, J.A., 8:12688
Glazov, A.A., Deuteron cyclotron complex on the base of superconducting sector magnets, 8:12895 (R;SU;In Russian)
Study on the supercyclotron cavity model excitation, 8:12920 (R;SU;In Russian)
Glenn, R.D., *See* Robinson, B., 8:13148
Glustrom, L., Acid rain: a background report, 8:13029 (R;US)
Godinger, D., *See* Samuni, A., 8:13180
Goff, D.A., Laser-excited atomic-fluorescence spectrometery as a tool for chemical analysis, 8:12756 (R;US)
Goff, F.E., *See* Hearn, B.C. Jr., 8:12189
See Thompson, J.M., 8:12209
Gohar, Y., EBT-P gamma-ray shielding analysis, 8:13512 (J;US)

Gol'dshtejn, V.A., Koltun sum rules testing in the (e, e'p) experiments on ^{3}He and ^{4}He, 8:13300 (RA;SU;In Russian)
Gold, R., Calibration of SSTR neutron dosimetry for TMI-2 applications, 8:12398 (R;US)
Gold, S.H., *See* Stamper, J.A., 8:13524
Goldberg, E.D., *See* Koide, M., 8:13094
Goldemberg, J., Energy issues and policies in Brazil, 8:12489 (R;BR)
See Moreira, J.R., 8:12031
Golden, T.G., *See* Maier, R.W., 8:11808
Goldston, R.J., Diagnostics for neutral-beam-heated tokamaks, 8:13446 (R;US)
Goldstone, L.A., *See* White, D.H., 8:12185, 8:12230, 8:12231, 8:12232, 8:12233, 8:12234, 8:12235, 8:12236
Goldstone, P.D., Antares facility for inertial-fusion experiments: status and plans, 8:13485 (R;US)
Gollon, P.J., Measurements of radial and longitudinal hadron shower development at 300 GeV, 8:12999 (J;NL)
Golovin, B.M., Elimination of ambiguity in determining track space orientation in multigap projection spark chambers, 8:12970 (R;SU;In Russian)
Golshani, A., Study of hydraulic air compression for Ocean Thermal Energy Conversion open-cycle application, 8:12132 (R;US)
Golub, G., *See* Meurant, G., 8:13541
Gomez, M., Radiation hazards in mining: control, measurement, and medical aspects, 8:13170 (B;US)
Goncalves, A.M.P., Dynamic aspects of the dye-sensitized photoconductivity of semiconductors. Technical progress report, April 1, 1981-March 31, 1983, 8:12733 (R;US)
Gonder, J.R., *See* Albert, D.M., 8:13185
Gong, E.Y., *See* McMaster, W.H., 8:12420
Gonzales, S., *See* Lomenick, T.F., 8:11898
Gonzalez, M.A., *See* Dreicer, M., 8:13092
Gonzalez, P., *See* Brunet, C., 8:13097
Goode, W.E., *See* Gladney, E.S., 8:13028
Goodin, J.R., Unconventional plants for biomass feedstocks in semi-arid West Texas. Final report, 8:12101 (R;US)
Goodman, M.M., *See* Knapp, F.F. Jr., 8:13131
Goodwin, A., *See* Knoefell, T.M.J., 8:12944
Goodwin, J.G. Jr., H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R;US)
Googin, J.M., Technical considerations in choosing alcohol fuels for less-developed countries, 8:12041 (R;US)
Gopal, J.S., Supercritical behavior in multicomponent system, 8:11635 (RA;US)
See Deshpande, G.V., 8:11634
See Holder, G.D., 8:11633
Gorbachev, L.V., *See* Manturov, G.N., 8:13351
Gordon, A.M.P.L., *See* Kathuria, S.P., 8:12966
Gordon, H., *See* Baltay, C., 8:13268
Gordon, J.J., Technology assessment of solar energy systems. Socioeconomic impacts of solar deployment and conventional energy use. Volume III, 8:12020 (R;US)
Gordon, R.G., Optimization of transparent electrode for solar cell. Technical report, 15 September 1981-14 September 1982, 8:12094 (R;US)
Gornushkin, Yu.A., *See* Golovin, B.M., 8:12970
Gorton, C.W., *See* Knight, J.A., 8:12075
Gottschalk, G., *See* Wiegel, J., 8:12105
Gough, R.A., *See* Abbott, S., 8:12896
Goulding, F.S., Design philosophy for high-resolution rate and throughput spectroscopy systems, 8:13443 (R;US)
Gourdin, W.H., Explosive consolidation of aluminum nitride ceramic powder: a case history, 8:12716 (R;US)
Microstructural modification of aluminum-silicon alloy powders during dynamic consolidation, 8:12691 (R;US)
Gourley, P.L., Ga(As,P) strained-layer superlattices: a ternary semiconductor with independently adjustable band gap and lattice constant, 8:12886 (R;US)
Gouveia, A.S. de, *See* Ishiguro, Y., 8:12312, 8:12313
Graboski, M., *See* Reed, T.B., 8:11983
Graboski, M.S., Comparison of coal and wood as feedstocks for methanol manufacture, 8:11658 (RA;US)
Graca, M.C., *See* Ballve, H., 8:12316
Graeber, B., *See* Schmitz, V., 8:12877
Graese, A.M., *See* Hower, J.C., 8:11669
Graevskij, A.I., *See* Bortnyanskij, A.L., 8:12928
Graf, J.M., Accident analysis and DOE criteria, 8:11927 (R;US)
Graham, R.A., *See* Beauchamp, E.K., 8:12715
Grannell, R.B., Repetitive precision gravity studies at the Cerro Prieto and Heber geothermal fields, 8:12201 (R;US)
Grant, N.R., *See* Spampinato, P.T., 8:13465
Grant, P.J., *See* Norman, E.B., 8:13227
Graves, D.J., Water retention properties of peat and their modification, 8:11748 (RA;US)
Water retention mechanisms in peat, 8:11749 (RA;US)
Graves, G., *See* Quam, W., 8:12980
Graves, R.S., *See* McElroy, D.L., 8:12558
Gray, A.R., Strategic factors influencing public investment in energy efficient mobility: load factors in vehicles, capital requirements for innovation, urban design constraints, market behavior, 8:12598 (RA;US)
Greacen, N.T., *See* Solomon, D.E., 8:13471
Grechukhin, D.P., Change of conversion factors of E3-transition in sup(235m)U at population variations of uranium atom shell valent zone orbits, 8:13354 (RA;SU;In Russian)
Green, D.W., Vapor pressures and vapor compositions in equilibrium with hypostoichiometric uranium dioxide at high temperatures, 8:12718 (J;NL)
Green, G.P., *See* Dahlin, R.S., 8:12281
Green, J.N., Control of information as an element of nuclear safeguards, 8:11942 (R;US)
Green, M.A., Design conditions for fail-safe quenching of a high-current-density superconducting solenoid with a shorted secondary circuit, 8:12852 (R;US)
Green, S.T., *See* Treat, C.H., 8:12169
Green, T.F., Development of a method to improve the efficiency of commercial and residential air-conditioning systems. Final report, 8:12574 (R;US)
Program planning document for energy-conservation research, development, and demonstration in Texas. Final report, 8:12550 (R;US)
Green, W.L., *See* Douglass, S.S., 8:12857
Greene, D.A., *See* Claytor, T.N., 8:12378
Greenwood, D.E., *See* Young, K.G., 8:13444
Greimann, L.F., *See* Fanous, F.S., 8:12402
Greiner, D.E., HISS spectrometer at the Bevalac, 8:13265 (R;US)
Gresho, P.M., Comments on a recent paper by Emery et al.: a comparison of some of the thermal characteristics of finite-element and finite-difference calculations of transient problems, 8:13418 (J;US)
Grew, P.C., Implications of the California Public Utilities Commission's decision on the proposed Southern California Edison/Chevron Resources Power Plant at Heber, California, 8:12225 (RA;US)
Griem, H.R., Spectroscopic density measurements in compressed plasmas, 8:13527 (BA;US)
Griffin, F. Jr., *See* Tvedt, T.J., 8:12302
Griffin, G.M., Florida peat resource assessment project, 8:11704 (RA;US)
Griffin, R.C., *See* Engler, C.R., 8:12102
Griffith, R.V., Developments in solid state detectors for personnel neutron dosimetry, 8:12982 (RA;US)
See Espinosa, G., 8:12983
Griffith, W.C., *See* Damon, E.G., 8:13154
See Eidson, A.F., 8:11930
Griffith, W.L., *See* Googin, J.M., 8:12041
Gril, Philip, Study of the antivsub(μ)p interactions with a liquid hydrogen sensitive target surrounded with a Ne-H_2 mixture, 8:13261 (R;FR;In French)
Grimes, P.G., *See* Malachesky, P.A., 8:12651
Grimesey, R.A., *See* Wheeler, F.J., 8:12339
Gringarten, A.C., Flow-test evaluation of fractured reservoirs, 8:13204 (J;US)
Grisham, D.L., Monitors 1980: now there are two, 8:12443 (J;US)
Grisham, L.R., Nuclear diagnostic for fast alpha particles, 8:13448 (R;US)
Grishma, D.L., Waste management at LAMPF, 8:11914 (J;US)
Groat, C.G., *See* White, D.M., 8:11721
Groebner, R.J., *See* Jahns, G.L., 8:13506
Gromme, C.S., *See* Mankinen, E.A., 8:12192
Gross, M.B., *See* Santee, G.E. Jr., 8:12390
Grotch, S.L., Experimental design and data analysis, 8:13536 (R;US)
Grubbs, S.R., Legal remedies for theft of electricity, 8:12502 (R;US)
Grun, J., *See* Stamper, J.A., 8:13524
Grunberger, D., *See* Santella, R.M., 8:13193
Gschneidner, K.A. Jr., Critical evaluation of binary-rare-earth phase diagrams. Progress report, March 1, 1982-May 31, 1982, 8:12673 (R;US)
Gudiksen, P., Joint research and development on toxic-material

emergency response between ENEA and LLNL. 1982 progress report, 8:13196 (R;US)
Gudiksen, P.H., *See* Crase, K.W., 8:13400
Guenther, P.T., *See* Budtz-Jorgensen, C., 8:13320
See Smith, A.B., 8:13319
Guidez, J., Effects of an annular fluid on the critical speed of a rotating shaft, 8:12349 (R;FR)
Guilmot, J.F., Harmonizatoin of data banks from energy model EFOM 12C with other Belgian data banks. Final report, 8:12461 (R;XE;FR)
Guldbakke, S., *See* Klein, H., 8:12961
Guldberg, J., *See* Fong, A., 8:12997
Gummesson, S., *See* Percival, W., 8:12081
Gunzburger, M.D., Finite element method for the Onsager pancake equation, 8:11844 (J;NL)
Guptill, F.E., *See* Schlinger, W.G., 8:11588
Gurtler, R.W., *See* Sarma, K.R., 8:12098
Gusev, V.P., *See* Anan'in, O.B., 8:12922
Guseva, T.V., Calculation of parameters of non-adiabatic rotational model for the sup(153,155,157,159)Eu, 8:13336 (RA;SU;In Russian)
Gushee, D.E., *See* Jelinek, R.V., 8:11776
Gust, W.H., Shock-compression parameters for uranium dioxide from 5 to 330 GPa, 8:11846 (J;NL)
Gustafson, J.L., Asymptotic formulas for elliptic integrals, 8:13417 (R;US)
Gustavson, D.B., Fastbus software progress, 8:13566 (R;US)
See Deiss, S.R., 8:13565
Gutbrod, H.H., 4 π physics with the plastic ball, 8:13297 (R;US)
Gutmacher, R.G., *See* Vook, R.W., 8:12695
Guven, N., Clay-based geothermal drilling fluids, 8:12249 (R;US)
Guzdar, A.R., Feeding coal and biomass into high pressure reactors, 8:12090 (RA;US)

H

Hackenbracht, W.N., Evaluation of land ownership, lease status, and surface features in five geopressured geothermal prospects, 8:12229 (R;US)
Hackett, P.L., *See* Kelman, B.J., 8:13167
Hadley, D.M., *See* Apsel, R.J., 8:13212
Hadlock, D.E., *See* Munson, L.F., 8:13049
Haeuser, J., *See* Eppel, D., 8:13415
Haff, K.W., Radioisotope-powered light sources, 8:11946 (R;US)
Hagelstein, P.L., Resonantly-pumped soft-x-ray lasers using ICF drivers, 8:13497 (R;US)
Hagen, E.W., Control and instrumentation, 8:12363 (J;US)
Hagmann, P., *See* Becker, E.W., 8:11843
Hagopian, J.H., *See* Athens, P., 8:13027
Haid, G., Organizational measures to be taken to enable the official dose records offices to meet the requirements of legislation, 8:13390 (RA;DE;In German)
Haidt, D., *See* Bartel, W., 8:13256
Haight, R.C., Radioactive ions beams for studying astrophysical nuclear reactions, 8:12909 (R;US)
Hailer, H., *See* Salzmann, H., 8:13427, 8:13432
Haire, M.J., *See* Burch, W.D., 8:11847
Haire, R.G., *See* Peterson, J.R., 8:12775
Hajicek, D.R., *See* Talty, R.D., 8:11769
Hajnal, F., Feasible neutron dosimeter for stray neutron fields at PWRS, 8:12989 (RA;US)
Haki, A.R., Commercial nuclear-waste research and development program. Quarterly report, July-September 1982, 8:11874 (R;US)
Commercial nuclear waste research and development program. Annual report, fiscal year 1982, 8:11875 (R;US)
Hale, L.A., Energy utilization in tire manufacturing. Final report, 8:12619 (R;US)
Hales, J.M., *See* Easter, R.C., 8:13024
Hall, H.G., Lumen formation by epithelial cell lines in response to collagen overlay: a morphogenetic model in culture, 8:13119 (J;US)
Halleck, P.M., *See* Albright, J.N., 8:13060
Haller, E.E., *See* Fong, A., 8:12997
See Hansen, W.L., 8:12974
Haller, K.H., Design for lignite firing at the San Miguel Power Plant, 8:12272 (RA;US)
Hamblen, D.G., *See* Solomon, P.R., 8:11642
Hamel, W.R., Remote-Systems Demonstration Facility. Consolidated Fuel-Reprocessing Program, 8:12839 (R;US)
Hamilton, L.D., Comparing the health and environmental hazards of different energy systems, 8:13100 (R;US)
Hamilton, W., Costs and benefits of energy consumption by public transit, 8:12600 (RA;US)
Hampton, J.C., 1976 Hanford americium-exposure incident: histologic and autoradiographic observations on skin, 8:13150 (R;US)
Hamrick, J.T., Development of wood as an alternative fuel for gas turbine systems, 8:12079 (RA;US)
Hamstad, M.A., Acoustic emission under biaxial stresses in unflawed 21-6-9 and 304 stainless steel, 8:12701 (J;GB)
Handel, S.J., *See* Clarke, M.M., 8:11820
Handin, J., *See* Friedman, M., 8:13217
Hanecak, R., *See* Semelr, B.L., 8:13108
Hannigan, R.L., Quality assurance program for isotopic power systems, 8:12518 (R;US)
Hansen, D., Financing conservation and renewable energy in the eighties, 8:12548 (R;US)
Hansen, L.F., Summary of measurements and calculations of neutron and gamma-ray emission spectra from spheres pulsed with 14-MeV neutrons, 8:13378 (R;US)
Hansen, W., *See* Van Etten, D., 8:13042
Hansen, W.L., High-purity germanium crystal growing, 8:12974 (R;US)
Hansen, W.R., *See* Bowen, B.M., 8:13043
Hanson, A.L., *See* Kraner, H.W., 8:12943
Hanson, C.L., *See* Doggett, J.N., 8:13530
Hanson, J.B., *See* Chastain, C.J., 8:13121
Hansson, B., *See* Percival, W., 8:12081
Hanulik, J., Determination of the contamination and decontamination of the fuel basin of the nuclear-powered ship Otto Hahn, 8:12382 (R;CH;GE)
Harakeh, M.N., *See* Snover, K.A., 8:13316
Hardy, R.D., *See* Chhabildas, L.C., 8:12882
Harled, J.A., Evaluation of events involving service water systems in nuclear power plants, 8:12295 (R;US)
Harigaya, K., *See* Garnett, H.M., 8:13120
Harley, N.H., Dose to basal cells in bronchial epithelium from long-lived alpha emitters in uranium mines, 8:13171 (BA;US)
Harnar, R.R., *See* Hannigan, R.L., 8:12518
Harner, D.D., Socioeconomic issues associated with the use of peat as an energy resource, 8:11689 (RA;US)
Socioeconomic issues associated with the use of peat as an energy resource, 8:11730 (RA;US)
Harper, S.R., *See* Cross, W.H., 8:11684
Harrington, J.M., Detailed gravity survey of the Wilbur Springs area, California, 8:12207 (RA;US)
Harris, J.A., Financing a synthetic fuels plant, 8:12495 (RA;US)
Harris, K.L., Evaluation of hydrothermal resources of North Dakota. Phase III final technical report, 8:12198 (R;US)
Harris, P.B., *See* Abraham, K.M., 8:12456
Harris, W.L., *See* Martinez, R., 8:12260
Harrison, T.D., Intermediate photovoltaic system application experiment operational performance report. Volume 14. For Lovington Square Shopping Center, Lovington, New Mexico, July and August 1982, 8:12114 (R;US)
Hart, G.W., *See* Branz, H.M., 8:12109
Hart, M.N., *See* Bond, S.K., 8:12573
Hart, R.C., *See* Coover, H.W., 8:11596
Hart, R.S., *See* Apsel, R.J., 8:13212
Harten, A., On a class of high resolution total-variation-stable finite-difference schemes, 8:13413 (R;US)
Hartgen, D.T., Transportation energy: an overview, with emphasis on New York State, 8:12584 (RA;US)
Hartman, J.E., *See* Cheng, T.C., 8:12412
Hartman, L.B., *See* Aksarin, N., 8:12000
Hartwigsen, C.C., *See* Homann, P.S., 8:13157
Harvey, A.C., *See* Guzdar, A.R., 8:12090
Hasan, M.A., *See* Sun, C.R., 8:13243
Hasatani, M., *See* Alexander, J.H., 8:11660
Hashimoto, H., *See* Nishinomiya, S., 8:12018
Hassib, G.M., *See* Piesch, E., 8:12987, 8:13382
Hatcher, J.J., The physiological limitation of working in a radiation containment suit, 8:12860 (J;US)
Haubenreich, P.N., Superconducting magnets for fusion, 8:13503 (J;AT)
Hauenstein, D.E., Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R;US)
Hausel, W.D., *See* Banks, C.E., 8:11826
Haves, P., Solar-regenerated desiccant dehumidification. Final report, 8:12170 (R;US)
Haxton, W.C., *See* Cowan, G.A., 8:13233
Hayatsu, R., Organic compounds in meteorites and their origins, 8:13234 (J;DE)
Hayes, C.G., Fuel-rod vibration in two-phase flow, 8:12291 (R;US)

Fuel-rod vibration with reduced spacer spring preload, 8:12293 (R;US)
Haymaker, R., *See* Chan, L.H., 8:13250
Haymaker, R.W., Convexity of the effective potential, 8:13287 (R;US)
Hayman, R.B., *See* Bell, R.A., 8:12540
See Lyons, J.A., 8:13210
Haynes, R.J., *See* Millemann, R.E., 8:13063
Hayward, B.R., *See* Gold, R., 8:12398
Hazell, R.G., *See* Lebech, B., 8:12777
Hazeltine, R.D., *See* Mahajan, S.M., 8:13453
Hazleton, J.E., Feasibility analysis of a regional energy-development bank. Final report, 8:12463 (R;US)
Headley, T.J., *See* Ruppen, J.A., 8:12688
Heaney, S.I., Light, temperature and nitrogen as interacting factors affecting diel vertical migrations of dinoflagellates in culture, 8:13079 (J;GB)
Heard, H.C., *See* Mirkovich, V.V., 8:13221
Hearn, B.C. Jr., Clear Lake Volcanics: tectonic setting and magma sources, 8:12189 (RA;US)
See Donnelly-Nolan, J.M., 8:12190
See Futa, K., 8:12191
See Mankinen, E.A., 8:12192
Heath, D.C., *See* Bennett, D.E., 8:13184
Heatherly, L., *See* Jackson, G.L., 8:13479
Hedden, R.E., *See* Cremeans, A.H., 8:12165
Hedge, C.E., *See* Futa, K., 8:12191
Heft, R., Analysis of standard reference materials by absolute INAA, 8:12768 (J;CH)
Heid, K.R., *See* Robinson, B., 8:13148
Heijne, E.H.M., *See* Kraner, H.W., 8:12943
Hein, K.R.G., Application of dry additives on reducing SO_3 emission for brown coal-fired boilers, 8:12283 (RA;US)
Heinisch, H.L., Defect production in simulated cascades: cascade quenching and short-term annealing, 8:13481 (R;US)
Heinzelmann, M., Determination of skin dose in personnel contamination, 8:13387 (RA;DE;In German)
Experience in the calibration of contamination monitors, 8:12962 (RA;DE;In German)
Present state of 'Arbeitskreis Dosismessung' - recommendation on environmental monitoring, 8:13381 (RA;DE;In German)
Helenon, Charles, Study and organization of the maintenance of electronic equipment, 8:12838 (R;FR;In French)
Helm, D.C., Conceptual aspects of subsidence due to fluid withdrawal, 8:13201 (J;US)
Helmer, R.G., Efficiency calibration of a Ge detector for 30-2800 keV γ rays, 8:12996 (J;NL)
See McCullagh, C.M., 8:12948
Helstrom, J.J., *See* Mahoney, J.A., 8:11617
Henderson, C., *See* SethuRaman, S., 8:13019
Henderson, J.S., *See* Burns, R.E., 8:12336
Hendrickson, J.S., Phi production and the OZI rule in π^+d interactions at 10 GeV/c, 8:13263 (R;US)
Henein, N.A., Modified cetane scale for low-ignition-quality fuels, 8:11814 (B;US)
Henins, I., *See* Barnes, C.W., 8:13438
See Hoida, H.W., 8:13437
Hennig, K., *See* Hohmuth, K., 8:12472
Henning, C.D., Mirror advanced reactor study (MARS), 8:13468 (R;US)
Heppner, J., *See* Salzmann, H., 8:13427
Herbert, R.F. Jr., *See* Lewis, E.L., 8:11890
Hercules, D.M., Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R;US)
Herget, C.J., Extension of the Smith predictor, 8:12793 (R;US)
Herkenrath, H., Experimental investigation of the enthalpy- and mass flow-distribution in 16-rod clusters with BWR-PWR-geometries and conditions. Final report of the ISPRA test-series with the complete data set, 8:12290 (R;XE)
Herlevich, A., Engineering analysis of potential photosynthetic bacterial hydrogen-production systems, 8:11956 (R;US)
Herman, H., *See* Berndt, C.C., 8:12708
Herman, I.P., Wafer-scale laser lithography. I. Pyrolytic deposition of metal microstructures, 8:12887 (R;US)
Herman, R.G., *See* Klier, K., 8:11970
Herndon, J.N., Industry-standard manipulator integrated maintenance system. Consolidated Fuel-Reprocessing Program, 8:12842 (R;US)
Herold, H., *See* Deutsch, R., 8:13428, 8:13484
Herro, H.M., Hydrogen and deuterium diffusion in vanadium alloys, 8:12676 (R;US)
Hertel, N.E., *See* Kunimoto, Y., 8:13521
Hertzberg, A., *See* Bruckner, A.P., 8:12181
Hertzmark, D., Economic feasibility of agricultural alcohol production, 8:12035 (RA;BR)
Herz, J., Initial detailed designs for intermediate photovoltaic systems: office building, 8:12118 (R;US)
Hessel Andersen, N., *See* Lebech, B., 8:12779
Hesson, G.M., *See* Mohr, C.L., 8:12411
Hewitt, R., Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment, 8:12459 (R;US)
Hickok, W.W., Operating experience in burning lignite at Coal Creek Station, 8:11756 (RA;US)
Hickox, C.E., *See* Viney, C.E., 8:12873
Higgins, R.S., Developments in the use of low-rank coal in Australia, 8:11723 (RA;US)
Higgins, R.W., Operations manual: fiber-optics welder, 8:12846 (R;US)
Hildebrand, S.G., *See* Millemann, R.E., 8:13063
Hildebrandt, A.F., Non-residential groundwater-heat-pump retrofit demonstration. Final report, 8:12578 (R;US)
Hiler, E.A., Ethanol production in small- to medium-size facilities. Final report, 8:12103 (R;US)
On-site energy production from agricultural residues. Final report, 8:12104 (R;US)
See Engler, C.R., 8:12102
Hill, F.B., *See* Knaebel, K.S., 8:12748
Hill, H.Z., Comparative action spectra for pyrimidine dimer formation in Cloudman S91 mouse melanoma and EMT6 mouse mammary carcinoma cells, 8:13162 (J;GB)
Hill, L.E., Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R;US)
Hill, N.W., *See* Extermann, R.C., 8:13001
Hill, W.L., *See* McCurdy, G., 8:11969
Hillsman, E.L., *See* Bjornstad, D.J., 8:12065
Hinchliffe, I., *See* Bulos, F., 8:12897
Hinckley, J.P., Technical plan for the development of an assay system for INEL-stored TRU waste, 8:11933 (R;US)
Hindi, M.M., *See* Snover, K.A., 8:13316
Hindman, J.C., *See* Yuen, M.J., 8:13110
Hinga, K.R., Subseabed Disposal Program. Annual report, January-September 1981. Volume I: summary, 8:11908 (R;US)
Hingerty, B.E., *See* Santella, R.M., 8:13193
Hipple, D.L., Tests of cryogenic pigs for use in liquefied gas pipelines, 8:11821 (R;US)
Hirsch, K., *See* Salzmann, H., 8:13427, 8:13432
Hitchcock, T., *See* Iyer, H.M., 8:12204
Hmelo, A.B., X-ray topographic fractography of single crystals of molybdenum and niobium, 8:12667 (R;US)
Ho, A.L.B., Extended burnup fuel cycle optimization for pressurized water reactors, 8:12311 (D;US)
Ho, J.K., Advanced implementation of the Dantzig-Wolfe decomposition algorithm for linear programming, 8:13570 (J;NL)
Hoagland, K.E., Ecological studies of wood-boring bivalves in the vicinity of the Oyster Creek Nuclear Generating Station. Progress report, March-May 1982, 8:13175 (R;US)
Hoard, C.T., Vacuum pipe for e^+e^- interactions, 8:12933 (R;US)
Hobby, W., Energy, Texas, and the country, 8:12494 (RA;US)
Hochmann, P., Molecular Rydberg transitions. X. correlation algorithms for Rydberg term values, 8:13246 (J;DE)
Hodges, C.E., *See* Lott, D.F., 8:12131
Hoeschele, J.D., *See* Knapp, F.F. Jr., 8:13131
Hofert, M., Hadron personnel monitoring around high-energy proton accelerators, 8:12981 (RA;US)
Hoffman, D.M., Curing behavior of seven segmented polyurethane adhesives, 8:12728 (R;US)
Hoffman, M.A., Research on the HYLIFE liquid-first-wall concept for future laser-fusion reactors: liquid jet impact experiments. Final report No. 8, 8:13496 (R;US)
Hoffman, W.L., Barriers to household investment in residential energy conservation: preliminary assessment, 8:12566 (R;US)
Overcoming barriers to residential conservation: do energy audits help, 8:12567 (R;US)

Hoffmeister, G., Particle-size requirements for bulk blend materials. Circular Z-146, 8:12746 (R;US)
Hohmuth, K., Central Institute of Nuclear Research Rossendorf 25 years old, 8:12472 (R;DD;In German)
Holda, H.W., Spectroscopic studies of impurity control in coaxial sources for spheromaks at Los Alamos, 8:13437 (R;US)
See Barnes, C.W., 8:13438
Holsington, J.E., Radioisotopes for heat-source applications, 8:11953 (R;US)
Strontium-90 and promethium-147 recovery, 8:11951 (R;US)
Hokama, L., *See* Tuse, D., 8:13134
Holbrooks, O.R., *See* Menlove, H.O., 8:11939
Holder, G.D., Supercritical fluids for extraction and reaction of coal and heavy oils. First quarterly progress report, September 1, 1982-December 1, 1982, 8:11633 (R;US)
See Deshpande, G.V., 8:11634
See Gopal, J.S., 8:11635
Holder, R.S., Commercial energy costs for SOLCOST Data Bank cities, winter 1981-1982, 8:12014 (R;US)
Holl, J.M., United States Department of Energy: a history, 8:12487 (R;US)
Holland, J.W., *See* Miles, K.J., 8:12360
Hollander, E., Guiding R and D policy, 8:12473 (J;US)
Holmes, J.L., *See* Rosenstock, H.M., 8:12809
Holmes, M., *See* Cohen, A.D., 8:11698
Holt, B., *See* Isherwood, W., 8:12219
Holter, G.M., *See* Murphy, E.S., 8:12413
Holtzman, R.B., *See* Schlenker, R.A., 8:13166
Holzhauer, E., *See* Salzmann, H., 8:13427, 8:13432
Homann, P.S., Bibliography of the Beneficial Uses/Sewage-Sludge-Irradiation Project, 1974-1982, 8:13157 (R;US)
Honda, S., *See* Tamiya, K., 8:12702
Honea, F.I., Recent research on ash fouling in combustion of low-rank coals, 8:12275 (RA;US)
Hook, K.A., Evaluations of alternatives for on-site spent fuel storage, 8:11855 (J;US)
Hooper, R.J., Coal conversion in New Zealand: the South Island lignite programme, 8:11724 (RA;US)
Hootman, H.E., *See* Farber, M.G., 8:11877
Hoover, W.G., Rheology via nonequilibrium molecular dynamics, 8:13409 (R;US)
Hopke, P.K., *See* Williams, R.E., 8:12767
Hopkins, D.L., *See* Tsang, C.F., 8:12453
Hoppstaedter, K., *See* Schmitz, V., 8:12877
Horng, H.E., Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R;US)
Hornig, A.W., Thagard high-temperature fluid-wall reactor for syngas generation from biomass, 8:12091 (RA;US)
Horning, R.R., Computer-controlled data communications test center, 8:13550 (R;US)
Horst, T.W., Simple nocturnal slope-flow data from the Rattlesnake Mountain site, 8:13023 (R;US)
Hoskins, E.R., *See* Rao, C.D., 8:11726
Hosono, K., *See* Snover, K.A., 8:13316
Houston, W.N., Physical properties of porous geologic materials, 8:13202 (J;US)
Houver, J.C., *See* Fayeton, J.A., 8:13244
Howard, D., *See* Abbott, S., 8:12896
Howe, T.M., *See* Buescher, B.J., 8:12434
Howell, F.L., *See* Harris, K.L., 8:12198
Howell, J.R., Demonstration of desiccant dehumidification components compatible with solar-powered residential cooling systems. Final report, 8:12579 (R;US)
Howell, R.H., Low-energy-positron production at the Livermore linac, 8:12934 (R;US)
Hower, J.C., Petrographic characterization of Kentucky coals. Quarterly progress report, September 1982 - November 1982, 8:11669 (R;US)
See Lloyd, W.G., 8:11672
Hoy, H.C., Occupational risk from nuclear power, 8:11931 (J;US)
Hoyle, C.D., Isospin mixing in ^{24}Mg, 8:13315 (R;US)
Hsiao, M.Y., Velocity-space particle loss in field-reversed configurations, 8:13419 (R;US)
Hsu, C.H., Effect of stress on the transformation in nickel-titanium, 8:12677 (R;US)
Huang, S., *See* Alexander, W.A., 8:13066
Hubbard, H.M., *See* Alexander, W.A., 8:13066
Huck, R.W., State resource estimation: Alaska, 8:11693 (RA;US)
Huebner, M., Carbon-13 isotope values for carbon dioxide gas and dissolved carbon species in springs and wells in the Geysers-Clear Lake region, 8:12212 (RA;US)
Huffman, F., *See* Saunders, M., 8:12519
Huffman, J.C., *See* Sattelberger, A.P., 8:12796
Huffsmith, S.L., *See* Gourdin, W.H., 8:12716
Hufschmidt, W., *See* Herkenrath, H., 8:12290
Huggins, R.A., New battery materials. Final report, April 1, 1977-Dec. 31, 1979, 8:12460 (R;US)
Hughes, V.H., *See* Howell, R.H., 8:12934
Hugues, J.F., Non-enzymatic hydrolysis of carbohydrates, 8:12028 (RA;BR)
Hull, A.P., Emergency planning: life protection or ALARA, 8:12431 (J;US)
Hull, K., Recent developments in thick mercuric iodide spectrometers, 8:12946 (R;US)
See Beyerle, A., 8:12731
Hulme, B.L., Monotone Boolean approximation, 8:13563 (R;US)
Huning, J.R., Cloud-cover estimation: use of GOES imagery in development of cloud-cover data base for insolation assessment, 8:12012 (R;US)
Hunke, R.W., *See* Leonard, J.A., 8:12122
Hunt, D.N., DDCMP protocol on a DMA serial-line board, 8:13008 (R;US)
Hunter, J.A., Aggregation of low density lipoproteins with unilamellar phosphatidylcholine vesicles, 8:13109 (J;US)
Huntzinger, C.J., *See* Dreicer, M., 8:13092
Hurrell, S.J., Demonstration of microscopic process monitoring for reprocessing plant safeguards, 8:11943 (J;US)
Hurst, G.S., Personnel neutron dosimeters based on organic polymers, 8:12979 (RA;US)
Hurter, D.A., Impact of fuel regulations in automotive design and manufacturing, 8:12595 (RA;US)
Hurtubise, R.J., Solid-surface luminescence analysis. Progress report, June 1980-October 1982, 8:12804 (R;US)
Hussey, M.W., *See* Shen, E.J., 8:13482
Hwang, D., *See* Post, D., 8:13450
Hyde, A.P.S., Automotive fuel economy - improvement potentials and strategies: manufacturer's viewpoint, 8:12593 (RA;US)
Hyde, R.A., *See* Herman, I.P., 8:12887

I

Ibrahim, A., *See* Hildebrandt, A.F., 8:12578
Icayan, E.E., *See* Palmer, H.E., 8:13147
Ignatyuk, A.V., *See* Dovbenko, A.G., 8:13324
Igo, G.J., *See* Geaga, J.V., 8:13313
Igou, R.E., *See* Douglass, S.S., 8:12857
Iles, W.J., *See* Burgess, P.H., 8:12975
Inam, A., *See* Deutsch, R., 8:13428, 8:13484
Imlay, R., *See* Chan, L.H., 8:13250
Incropera, F.P., *See* Anderson, D.W., 8:11671
See Fetters, G.D., 8:11680
Ing, H., Spectral and dosimetric characteristics of a moderated-neutron calibration facility, 8:13399 (RA;US)
See Cross, W.G., 8:13397
Ingram, R.L., Peat resources of North Carolina, 8:11712 (RA;US)
State resource estimation: North Carolina, 8:11697 (RA;US)
Intemann, P.R., Applicability of earth coupled heat pumps and factors affecting their performance, 8:12557 (R;US)
Irons, J., *See* Walters, A., 8:11690
Irwin, K.J., *See* Goodwin, J.G. Jr., 8:11646
Isakov, V.I., *See* Badalov, S.A., 8:13346
Ishack, G., Methodology for the inspection of items important to safety. The Canadian approach, 8:12399 (R;CA)
Isherwood, W., Streamlining internal administrative procedures for geothermal development at the US Geological Survey, US Bureau of Land Management and the US Forest Service, 8:12219 (RA;US)
Isherwood, W.F., Geophysical overview of The Geysers, 8:12203 (RA;US)
Ishiguro, Y., JFS libraries and the effect of beryllium on the breeding, 8:12313 (R;BR;In Portuguese)
Possible types of breeders with thorium cycle, 8:12312 (R;BR;In Portuguese)
Ishikawa, K., *See* Schierholz, G., 8:13269
Iskander, S.K., *See* Cheverton, R.D., 8:12439

Ivan, J., Intake of ^{226}Ra by ingestion and its evaluation in a selected population group, 8:13095 (TJ;US)
Ivashkevich, S.A., *See* Alenitskij, Yu.G., 8:12902
Iveson, R., *See* Douglas, J., 8:12286
Iyer, H.M., Large teleseismic P-wave delays in the Geysers-Clear Lake geothermal area, 8:12204 (RA;US)

J

Jackson, D.M., *See* Freel, J., 8:11595
Jackson, G.A., Larval mortality from offshore mixing as a link between precompetent and competent periods of development, 8:13076 (J;US)
Jackson, G.L., Initial wall conditioning in Doublet III, 8:13479 (R;US)
Jackson, P.L., Appraisal of landsat lineaments as faults in western Kentucky. Final report, 8:11816 (R;US)
Jackson, P.O., *See* Young, J.A., 8:13044
Jackson, W.P., Separation of asphaltenes using high-resolution supercritical-fluid chromatography. Progress report, September 1-November 30, 1982, 8:12750 (R;US)
Jacobs, D.G., *See* Mahathy, J.M., 8:12858
Jacobs, G., *See* White, A.L., 8:12637
Jacobs, R.A., Operational status of 134 solar water heaters in the southeastern United States, 8:12150 (RA;US)
Jacobsen, F.K., *See* Orvis, D.D., 8:11896
Jacobson, R.O., Report of investigation for hydroelectric generation. Final report, 8:11996 (R;US)
Jacquot, C., *See* Clegg, T.B., 8:13235
Jaeger, U., *See* Deutsch, R., 8:13428, 8:13484
Jahns, G.L., Dynamic behaviour of intrinsic impurities in Doublet III discharges, 8:13506 (J;AT)
Jahr, R., *See* Alberts, W.G., 8:12956
See Klein, H., 8:12961
Jaklevic, J.M., *See* Thompson, A.C., 8:12764
Jang, L.K., Correlation of petroleum component properties for caustic flooding, 8:12772 (J;US)
Jankovich, E., *See* Rosenfield, A.R., 8:12705
Jansen, H., *See* Goldstone, P.D., 8:13485
Janzen, G., *See* McCarthy, A.L., 8:13430
See Raeuchle, E., 8:13425
Jarboe, T.R., *See* Barnes, C.W., 8:13438
See Hoida, H.W., 8:13437
Jardin, S.C., Feedback stabilization of rigid axisymmetric modes in tokamaks, 8:13510 (J;AT)
Jaros, J.A., Measurement of the tau lifetime, 8:13266 (R;US)
Jarrett, P.M., Peat testing standardization, 8:11666 (RA;US)
Jasas, G., Gas turbine demonstration of pyrolysis-derived fuels, 8:12080 (RA;US)
Jassby, D.L., *See* Micklich, B.J., 8:13518
Javeri, V., Analysis of hypothetical accidents in fast breeder reactors. Part III. Supplementary analysis of coolant disruption for Mark 1A burned-up core of the SNR-300 with the SAS 3D computer program, 8:12395 (R;DE;GE)
Jech, J.J., 1976 Hanford americium-exposure incident: external decontamination procedures, 8:13145 (R;US)
See Berry, J.R., 8:13146
Jeffery, J.P., *See* Clements, L.D., 8:11964
Jelinek, R.V., Synthetic fuel costs vs oil price, 8:11776 (RA;US)
Jenkins, R.A., *See* Brazell, R.S., 8:13189
Jenne, E.A., *See* Deutsch, W.J., 8:11916
Jensen, A.L., Application of a surplus production model to assess environmental impacts on exploited populations of Daphnia pulex in the laboratory, 8:13159 (J;GB)
Jeppson, D.W., Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R;US)
Jessop, E.S., *See* Cady, W.E., 8:12727
Jevec, J.M., *See* Chen, C.M., 8:12306
Jirka, A., Mass and mutagenicity balances in chemical fractionations, 8:13178 (R;US)
Joergensen, J.-E., Neutron and X-ray diffraction on Nb_3Ge, 8:12780 (RA;DK;In Danish)
Johansson, B., *See* Staun Olsen, J., 8:12778
John, R., Nature and characteristics of federal fuel economy standards, 8:12594 (RA;US)
Johnsen, R.H., Radiation-induced effects in organic systems. Final report, 8:12819 (R;US)
Johnson, A.J., Savannah River Laboratory local area computer network, 8:13547 (R;US)
Johnson, C.E., *See* Rothman, S.J., 8:12694
Johnson, D., High-beta experiments with neutral-beam injection on PDX, 8:13449 (R;US)
Johnson, D.W., *See* Olson, R.J., 8:13062
See Peterson, C.W., 8:12871
Johnson, E.F., *See* Buxbaum, R.E., 8:13495
Johnson, G.K., *See* Kaufman, A., 8:12522
Johnson, J.A., Coincident inspection: FY-82 report, 8:12878 (R;US)
See Barna, B.A., 8:12879
Johnson, J.K., 9.6 appendix F: analysis of rheological data for SRC solvent coal slurries: Ft. Lewis and Wilsonville solvents, 8:11656 (RA;US)
Coal slurry mixing: residence time and temperature effects on SRC feed slurries, 8:11655 (R;US)
Johnson, K.S., *See* Lomenick, T.F., 8:11898
Johnson, L.A., *See* Engler, C.R., 8:12102
Johnson, W.C., *See* Hale, L.A., 8:12619
Johnston, J.W., *See* Owzarski, P.C., 8:11860
Joliot, P., Investigation of electron-transport mechanisms in photosynthesis. Final report, 8:13127 (R;XE)
Jonca, A., *See* Berndt, C.C., 8:12708
Jones, A.K., *See* Price, R.H., 8:13219
Jones, A.V., Fluid-structure coupling in Lagrange-Lagrange and Euler-Lagrange descriptions, 8:12392 (R;XE)
Jones, J.W., Groundwater-source heat-pump design development: consideration of locally variable factors. Final report, 8:12580 (R;US)
Jones, K.W., *See* Kraner, H.W., 8:12943
Jones, M.L., *See* Honea, F.I., 8:12275
Jones, P.A., Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture, 8:13116 (J;US)
See Werb, Z., 8:13123
Jones, R.H., Use of analytical electron microscopy and auger electron spectroscopy for evaluating materials, 8:12760 (R;US)
Jones, R.W., SLR methods for attached sunspaces, 8:12162 (R;US)
Jones, W.M., Comparison of the results from six regional solar water heater field test programs, 8:12145 (RA;US)
Jonish, J.E., *See* Hill, L.E., 8:12017
Jordan, J., Instrumental methods of analysis of sulfur compounds in synfuel process streams. Quarterly technical progress report, July-September 1982, 8:11670 (R;US)
Joseph, B.J., *See* May, R.A., 8:12863
Jowzani-Moghaddam, A., Integral transport multiregion geometrical shadowing factor for the approximate collision probability matrix calculation of infinite closely packed lattices, 8:12347 (D;US)
Joyce, G., *See* Wang, C.L., 8:13461
Juhasz, A.J., Methods of reducing energy consumption of the oxidant-supply system for MHD/steam power plants, 8:12516 (R;US)
Jung, U., *See* Herkenrath, H., 8:12290

K

Kadantseva, E.P., Convergence of a difference approximation of self-consistent system of Maxwell equations on a class of discontinuous solutions, 8:12904 (R;SU;In Russian)
See Dolya, S.N., 8:13377
Kadmenskij, S.G., Momentum spectra in reactions of quasi-elastic knock-out of deuteron, 8:13333 (RA;SU;In Russian)
See Vakhtel', V.M., 8:13345
Kaeppeler, H.J., *See* Deutsch, R., 8:13428, 8:13484
Kahn, D.R., Hydrogasification of peat, 8:11610 (RA;US)
Kahn, J.S., Leadership opportunities in the new age, 8:13099 (R;US)
Kaiser, W.R., *See* White, D.M., 8:11721
Kal'ner, V.D., Studying the phase composition of surface zones in white layers obtained during steel frictional-strengthening treatment, 8:12672 (RA;SU;In Russian)
Kale, H.W. II, *See* Nesbitt, S.A., 8:13055
Kalinichenko, V.V., *See* Glazov, A.A., 8:12895
Kalkwarf, D.R., 1976 Hanford americium-exposure incident: urinary excretion of trace metals during DTPA treatments, 8:13151 (R;US)
Kam, K.K., Detailed photocurrent spectroscopy of the semiconducting

group VI transition metal dichalcogenides, 8:12811 (J;US)
Electrical properties of WSe_2, WS_2, $MoSe_2$, MoS_2, and their use as photoanodes in a semiconductor/liquid junction solar cell, 8:12062 (R;US)
Kamada, H., *See* Tamiya, K., 8:12702
Kammash, T., *See* Cooper, W.A., 8:13523
See Nguyen, K., 8:13458
Kandebo, S.W., *See* Graves, D.J., 8:11749
Kang, Y.S., Topics in phenomenology of unified gauge theories of weak, electromagnetic, and strong interactions, 8:13289 (R;US)
Kanofsky, A.S., *See* Sun, C.R., 8:13243
Kaplan, E., Pulmonary function and /sup 81m/Kr scans in obstructive pulmonary disease, 8:13133 (J;GB)
Kapoor, S., *See* Carlisle, C.T., 8:11796
Kapoun, K., Sixth conference of Czechoslovak physicists. Part 1. Volume 1, 8:13225 (R;CS;CZ)
Karma, A.S., Dynamic Monte Carlo simulation of the one-dimensional Potts model, 8:13403 (R;US)
Karnaukhov, I.M., *See* Derkach, A.Ya., 8:12924
Karpeshin, F.F., Radiationless excitation of the nucleus in the ^{238}U muonic atoms, 8:13241 (RA;SU;In Russian)
Karpinovitch, Z., *See* Eisen, Y., 8:12985
Karpuk, M., *See* Herlevich, A., 8:11956
Karvelas, L.P., *See* Dickson, J.C., 8:11809
Kasim, A.G., *See* Houston, W.N., 8:13202
Kasner, W.H., Laser-beam-alignment system, 8:12866 (P;US)
Kasparek, W., *See* Salzmann, H., 8:13427, 8:13432
Kasper, J., *See* Jasas, G., 8:12080
Kasten, F., Global and diffuse solar radiation dependent on cloud amount and turbidity, 8:12005 (RA;CH)
Katan, I.B., Entry format for representation of analytical relations on the ES computer, 8:13549 (R;SU;In Russian)
Kathuria, S.P., Dosimetric characteristics and radiation monitoring with $CaSO_4$(Dy):NaCl pellets, 8:12966 (R;BR)
Katz, J.J., *See* Yuen, M.J., 8:13110
Katzen, R., Low energy motor fuel grade alcohol distillation systems, 8:11968 (RA;BR)
Katzner, J.R., *See* Gates, B.C., 8:11612
Kauffman, J.D., *See* Venkatakrishnan, R., 8:13208
Kaufman, A., Develop and test fuel-cell-powered on-site integrated total-energy systems: Phase III, full-scale power plant development. 5th quarterly report, February-April, 1982, 8:12522 (R;US)
Kaun, K.H., *See* Hohmuth, K., 8:12472
Kaune, W.T., *See* Phillips, R.D., 8:13194
Kavanaugh, S., *See* Mei, H.T., 8:12577
Kaye, J.H., *See* Brauer, F.P., 8:12770
Kazacha, V.I., Magnetic system of induction section for accelerating an electron-ion ring, 8:12903 (R;SU;In Russian)
Kazarinov, M.I., *See* Barts, B.I., 8:13361
Kearns, D.L., *See* Ciliberti, D.F., 8:11627
Keane, A.T., *See* Schlenker, R.A., 8:13166
Kearney, D.W., *See* Casper, R.A., 8:12166
Kee, R.J., *See* Miller, J.A., 8:11965
Keefe, D., *See* Cooper, R.K., 8:12865
Keelin, T.W., Generating capacity in US electric utilities: how is it used; how much is needed over the decade, 8:12505 (R;US)
Keeney, R.C., *See* Davis, R.J., 8:12183
Keizer, R.L., Radiation-resistent magnets, 8:12914 (R;XC)
Keller, K.J., Power shovel data accumulator and display. Final report, September 1982, 8:11733 (R;US)
Keller, L.J., Industrial potentials of coal-alcohol slurry fuels, 8:11763 (RA;US)
Keller, W.E., Magnetic refrigeration: the basis for a new refrigeration technology. Los Alamos Mini-Review, 8:12851 (R;US)
Kelly, G.M., *See* Lindsey, G., 8:11994
Kelly, J.F., Commercial availability of coal-oil and coal-water fuels, 8:11760 (RA;US)
Kelly, V.P., *See* Klos, D.B., 8:13532
See Shen, E.J., 8:13482
Kelman, B.J., Effects of monomeric ^{239}Pu on the pregnant rabbit, 8:13167 (J;GB)
Kelsey, J.R., Geothermal technology development program. Annual progress report, October 1980-September 1981, 8:12247 (R;US)
Wellborne inertial navigation system, 8:13213 (R;US)
Kemmler, G., *See* Damerau, G., 8:11885, 8:11886
Kennedy, L.A., *See* Weller, S.W., 8:11679
Kennedy, W.E. Jr., Potential role of biotic transport models in low-level-waste management, 8:11901 (R;US)
Kent, B., Sunspaces: design and build an attached solar greenhouse, 8:12163 (R;US)
Keough, R.F., *See* Jeppson, D.W., 8:13483
Kerimov, B.K., *See* Bogdanov, Yu.P., 8:13310, 8:13311
Kerr, G.D., Review of dosimetry for the atomic bomb survivors, 8:13158 (J;US)
Kershner, C.J., Tritium permeation scoping test, 8:13486 (R;US)
Kerstein, A.R., Percolation in combusting sprays I: transition from cluster combustion to percolate combustion in non-premixed sprays, 8:12834 (RA;US)
Kessler, G.C., *See* Hunt, D.N., 8:13008
Khandekar, D.C., *See* Menon, S.V.G., 8:12338
Kharitonov, Yu.I., *See* Sergeenkov, Yu.V., 8:13342
Khrisanfov, Yu.V., *See* Zarubin, P.P., 8:13332
Kienle, C.F., Faults and lineaments of the Southern Cascades, Oregon. Special paper No. 13, 8:13207 (R;US)
Kierstead, J.A., *See* Schwartzman, R.G., 8:13216
Kieschnick, R.L. Jr., *See* Weatherby, J.L. Jr., 8:12467
Kim, I.J., *See* Sun, C.R., 8:13243
Kim, K.Y., *See* Ebner, W.B., 8:12457
Kincaid, C.T., *See* Onishi, Y., 8:13090
King, D., District heating: legal, institutional, and public relations aspects, 8:12224 (RA;US)
King, E.B., *See* Vanderlaan, M., 8:13112
King, J.J., Earthquake catalog for the eastern Snake River Plain region, Idaho (43.0°-44.5°N, 111.5°-114.0°W), October 1972-June 1982, 8:13209 (R;US)
King, L.L., *See* Mohr, C.L., 8:12411
King, R.B., *See* Brown, G.M., 8:12795
Kingston, K., Advanced concentrator cell-mount analysis. Final report, 8:12085 (R;US)
Kinman, R., *See* Walsh, J., 8:11959
Kippermann, A.H.M., Competitive investigations of oxidation processes for silicon MIS-solar cells. Final report, 8:12058 (R;XE)
Kirby, P.B., Drift mobilities by time-of-flight methods and time-dependent phototransport in the nanosecond regime in amorphous semiconductors, 8:12734 (R;US)
Kirchesch, P., Light scattering measurements on plasma focus, 8:13433 (R;DE;In German)
Kirk, B.L., *See* Nir, A., 8:13197
Kirkwood, C.W., Screening for monitored retrievable storage facility locations, 8:11857 (J;US)
Kirsch, L., *See* Bensinger, J., 8:13254
Kirschner, C., Preliminary economic assessment or residential passive solar cooling potential in the United States, 8:12160 (R;US)
Kissel, L., UFO (UnFold Operator) computer program abstract, 8:13562 (R;US)
Kitagaki, T., Double Regge exchange in rho $\Delta\pi$ and rho rho N final states from π^- p interactions at 8 GeV/c, 8:13257 (R;US)
Kitchell, J.A., *See* DeAngelis, D.L., 8:13073
Klaus, E.E., *See* Liauh, W.C., 8:11804
Klein, H., Measuring the neutron sensitivity of a Geiger-Mueller counter by time-of-flight spectroscopy, 8:12961 (RA;DE;In German)
Klein, S.M., Adsorption of ethanol and water vapor by Silicalite, a hydrophobic molecular sieve, 8:12061 (R;US)
Kleinhenz, N.J., *See* Carpenter, P.F., 8:12891
Kleinhofs, A., *See* Nilan, R.A., 8:13103
Klepper, O.H., *See* Bjornstad, D.J., 8:12065
Klier, K., Catalysts for alcohols from biomass, 8:11970 (R;US)
Methanol synthesis, 8:11984 (RA;US)
Klos, D.B., Remote handling features of the fusion materials irradiation test (FMIT) facility, 8:13532 (J;US)
Kluge, H., *See* Alberts, W.G., 8:12956
Knaebel, K.S., Analysis of gas purification by heatless adsorption, 8:12748 (R;US)
Knapp, F.F. Jr., Nuclear medicine progress report for quarter ending September 30, 1982, 8:13131 (R;US)
Knauf, K., *See* Alberts, W.G., 8:12956
Knickerbocker, J.U., Orientation of ceramic microstructures by hot-forming methods, 8:12707 (R;US)
Knickerbocker, S.H., Fracture of hot-pressed silicon nitride at elevated temperatures, 8:12706 (R;US)
Knight, C.E. Jr., *See* Dobie, M.J., 8:12720
Knight, G.D., Pending changes in the regulation of solid waste disposal and underground injection: impact of state programs in lieu of federal programs, 8:12221 (RA;US)

Knight, J.A., Entrained flow pyrolysis of biomass, 8:12075 (RA;US)
Knight, J.R., *See* Renier, J.P., 8:12438
Knoefell, T.M.J., Radon and radon-daughter exposure measurements by through-etched track registration in cellulose nitrate, 8:12944 (R;BR)
Knorr, G.E., Theoretical aspects of mirror fusion. Progress report, 1 October 1982-31 December 1982, 8:13421 (R;US)
Knowlton, T.M., *See* Paganessi, J.E., 8:11747
Knox, S.O., *See* Barnes, C.W., 8:13438
See Hoida, H.W., 8:13437
Knutson, C.F., Screening of three proposed DOE geopressured-geothermal aquifer natural gas project areas for potential conflicting commercial production: Freshwater Bayou, Lake Theriot, and Kaplan, Louisiana, 8:12200 (R;US)
Ko, S.C., *See* Kirkwood, C.W., 8:11857
Kobysheva, N.V., Climatic parameters for wind and solar power engineering, 8:12011 (RA;CH)
Koch, E.E., *See* Lau, H.J., 8:12732
Kocherhaus, J.G., *See* Nelson, R.A., 8:11897
Kochkin, V.A., *See* Glazov, A.A., 8:12920
Kochurov, B.P., *See* Vostrikov, M.A., 8:12341
Koczynski, A., *See* Hofert, M., 8:12981
Koestner, R.J., LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R;US)
Koevesi-Domokos, S., *See* Domokos, G., 8:13286
Kohler, T.P., Integrated-circuit control for two-lamp electronic ballast. Final report, 8:12561 (R;US)
Kohn, H.I., Radiation-induced risk of resettling Bikini atoll. Final report, November 7, 1981-May 28, 1982, 8:13140 (R;US)
Koide, M., Am-241/Pu-239 + 240 ratios in the marine environment, 8:13094 (J;GB)
Kok, M., *See* Adam, R.F.J., 8:11732
Kol'ga, V.V., *See* Glazov, A.A., 8:12895
Kolb, E.W., Survival of primordial color fluctuations, 8:13232 (J;NL)
Koleda, M.S., Shape and pace of the United Staes synthetic fuels industry, 8:11779 (RA;US)
Kolesnikov, N.N., Coulomb and total energies of light nuclei, 8:13368 (RA;SU;In Russian)
See Kopylov, V.A., 8:13298
Kolesov, I.V., *See* Anan'in, O.B., 8:12922
Kolibal, J.G., *See* Ku, L., 8:13511
Kolipari, R., *See* Berndt, C.C., 8:12708
Kolomiets, V.M., Corrections to nuclear hydrodymamics, due to dynamical deformation of the Fermi surface, 8:13364 (RA;SU;In Russian)
Nonlinear response and collective motion in nuclei at large amplitudes in time-dependent Hartree-Fock approximation, 8:13365 (RA;SU;In Russian)
Komarov, A.V., Method for analysis of averages over transmission energy of resonance neutrons, 8:13376 (RA;SU;In Russian)
Komoriya, H., Fuel management modeling with REBUS-2 for research and test reactors, 8:12376 (J;US)
Reduced-enrichment fuel element loading calculations for the Ford Nuclear Reactor, 8:12380 (J;US)
Komoto, T.T., *See* Hansen, L.F., 8:13378
Konicek, C.F., *See* Rothman, S.J., 8:12694
Konle, W., *See* Wilhelm, R., 8:13431
Konzak, C.F., *See* Nilan, R.A., 8:13103
Kopsick, D.A., Geochemistry of leachates from selected coal mining and combustion wastes. Project completion report, July 1977-September 1979, 8:11692 (R;US)
Kopstein, M.J., Peat conversion and utilization in the United States, 8:11719 (RA;US)
Kopylov, V.A., Contribution of the S′ state in Bsub(lambda)(sub(lambda)sup(3)H), 8:13298 (RA;SU;In Russian)
Kos, H.J., Recent investigations of the thermoluminescence mechanisme in lithium fluoride, 8:12950 (RA;DE;In German)
Kosiewicz, C.E., *See* Wray, W.O., 8:12161
Koskelainen, L., A model for optimal design of district heating networks, 8:12641 (R;US)
Koslow, J.A., Feeding selectivity of schools of northern anchovy, Engraulis mordax, in the Southern California Bight, 8:13078 (J;US)
Kosowski, G.M., Development of biomass gasification to produce substitute fuels, 8:12072 (RA;US)
Koster, E.C., Louisiana peat resources assessment, 8:11706 (RA;US)
Kosukhin, V.V., *See* Kazacha, V.I., 8:12903
Koszykowski, M.L., *See* Noid, D.W., 8:13412
Koszykowski, R., *See* Heft, R., 8:12768
Kotowski, J.A., *See* Wiltsee, G.A., 8:11582
Kovac, R.J., *See* Knight, J.A., 8:12075
Kovach, R.L., *See* Denlinger, R.P., 8:12205
Kovalenko, T.P., *See* Filippov, G.F., 8:13299
Kozhamkulov, T.A., Meson theory of the nuclear forces, 8:13359 (RA;SU;In Russian)
Kozhukhov, I.V., *See* Kazacha, V.I., 8:12903
Kozlovskij, I.V., *See* Malyarzh, E.I., 8:13301
Kozlowski, T., *See* Oothoudt, M.A., 8:13551
Kozyrev, Yu.P., *See* Anan'in, O.B., 8:12922
Kramer, G., *See* Lampe, B., 8:13270
Kramer, R., Relationship of body doses and dose equivalent index in case of external gamma and X-radiation, 8:13384 (RA;DE;In German)
Kramlich, J., *See* England, G., 8:11961
Kraner, H.W., Charge collection in silicon strip detectors, 8:12943 (R;US)
Krasnopol'skij, V.M., Detailed investigation of ground state structure of ^{6}Li-^{6}He-^{6}Be nuclei, 8:13307 (RA;SU;In Russian)
Kratsikova, T.I., *See* Vdovin, A.I., 8:13325
Krause, P.C., *See* Gareis, G.E., 8:12285
Kraynik, A.M., Rheology of thermoplastic foam extrusion, 8:12725 (R;US)
Krebs Larsen, F., *See* Lebech, B., 8:12777
Krehbiel, H., *See* Bartel, W., 8:13256
Kreider, J.F., *See* Waller, L.H., 8:12152
Kreitler, C., Groundwater-source heat-pump design development for Texas. Volume I. Resource. Final report, 8:12571 (R;US)
Krinsky, S., Brookhaven free-electron laser experiment, 8:12937 (R;US)
Kritz, M.V., Library of Modulef subroutines, 8:13556 (R;BR;In Portuguese)
Krois, P., *See* Brummert, L., 8:12845
Kronenberg, S., Gamma and fast neutron dosimetry with leuko dye optical waveguides, 8:12977 (RA;US)
Kroodsma, R.L., Bird communities and vegetation structure in pine plantations of the southeastern Coastal Plain, 8:13052 (R;US)
Krueger, E.H., Development of a multiwire proportional chamber for nanodosimetry measurement of the energy deposition of alpha particles in smallest sensitive volumina, 8:12964 (R;DE;In German)
Kruer, W.L., Nonlinear rehavior of stimulated scatter in large underdense plasmas, 8:13526 (BA;US)
Krupar, J.J., Breeder reactor program T-3 cask, 8:12445 (J;US)
Krupka, K.M., *See* Deutsch, W.J., 8:11916
Krusic, P.J., An ESR study of olefin iron carbonyl radical anions, 8:12799 (J;US)
Krutov, V.A., Relativistic effects in a nucleus and nuclear forces and models, 8:13360 (RA;SU;In Russian)
Ku, L., Systematic investigtion of material activation on the TFTR, 8:13511 (J;US)
Ku, L.P., Analysis of dd fusion neutron transport in thick concrete, 8:13515 (J;US)
Kuban, D.P., Consolidated Fuel-Reprocessing Program. ASM mechanical system, 8:12841 (R;US)
See Martin, H.L., 8:12844
See Spampinato, P.T., 8:13465
Kube, W.R., Technology and use of lignite, 8:11718 (R;US)
Kuehn, K., Phagocytosis of particulate nickel compounds by rat peritoneal macrophages in vitro, 8:13190 (J;US)
Kuehner, J., Impact of biomass-derived energy programs, 8:12034 (RA;BR)
Kuemmerle, N.B., Effect of mutations in the uthetarD cistron of Escherichia coli on repair resynthesis, 8:13168 (J;NL)
Kuhlmann, E., *See* Snover, K.A., 8:13316
Kujal, B., *See* Kujal, J., 8:12321
Kujal, J., In-pile fuel cycle of heterogeneous oxide fast reactors, 8:12321 (TG;GB)
Kukiel, E., Fission of natural uranium in tumor and normal tissue, 8:13173 (TJ;US)
Kukulin, V.I., Non-Born methods in the direct nuclear reaction theory, 8:13371 (RA;SU;In Russian)
See Krasnopol'skij, V.M., 8:13307
Kulash, D.J., Energy efficiency: which modes, which programs, 8:12596 (RA;US)
Kunceva, M., Determination of the corrosion rate of Ni-Fe coatings by measuring polarization resistance, 8:12703 (TJ;US)

Kunimoto, Y., A care inventory model for fuel trajectory analysis in fusion-fission symbiotic systems, 8:13521 (J;US)
Kuo, D.M., Comparative analysis of peat gasification reactor configurations, 8:11606 (RA;US)
Comparative analysis of peat gasification reactor configurations, 8:11611 (RA;US)
Kuprikov, V.I., *See* Zhalov, M.B., 8:13327
Kurtz, S., *See* Gordon, R.G., 8:12094
Kutbi, I.I., Reliability and system analysis of nuclear desalination plants based on operation experience, 8:12288 (D;US)
Kuz'menko, V.S., *See* Derkach, A.Ya., 8:12924
Kvick, T., *See* Bodin, S., 8:12009
Kwan, Y., *See* England, G., 8:11961
Kwart, H., *See* Gates, B.C., 8:11612, 8:11619
Kwong, W., *See* Schonfeld, J.F., 8:13411

L

Laats, E.T., NRC/DAE reactor safety research Data Bank, 8:12387 (R;US)
Lacewell, R.D., *See* Engler, C.R., 8:12102
Lacey, J.A., *See* Sharman, R.B., 8:11587
LaCroix, L.V., Flow-induced vibration characteristics of the BWR/5-201 jet pump, 8:12292 (R;US)
Ladd, T.A., Laws and regulations governing procurement, 8:12227 (RA;US)
LaDelfa, C.J., *See* Cortez, D.H., 8:12269
Lafoux, A., Optical properties of the "Montpellier" spectrometer deduced from magnetic field measurement, 8:12968 (R;FR;In French)
Lagonik, F., *See* Ciliberti, D.F., 8:11627
Lambarski, T.J., PV-cell data-reduction computer program (draft), 8:12087 (R;US)
Lambert, J.E., *See* Grisham, D.L., 8:12443
See Grishma, D.L., 8:11914
Lambert, J.R., *See* Baker, D.N., 8:13025
Lambert, S., Rate guide for commercial No. 2 heating oil and coal, 8:11781 (R;US)
Residential utility rate guide for SOLCOST data bank cities, 8:12636 (R;US)
Lambertson, G.R., Antiproton production and accumulation for a 20-TeV anti pp collider, 8:12907 (R;US)
Lamboley, G., Using weather forecasts for a more efficient use of heating systems, 8:12554 (RA;CH)
Lambrecht, R.M., Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R;US)
Lameiras, F.S., Evaluation of fuel rods behavior - under irradiation test, 8:12358 (R;BR;In Portuguese)
Lamont, J., *See* Douglas, J., 8:12286
Lamontagne, J., Simple method for estimating the maximum value of developing new electric power generation technologies, 8:12497 (R;US)
Lamoreaux, G.H., Structural analysis of the TRUPACT contact-handled Transuranic waste transporter, 8:11861 (J;US)
Lampe, B., Application of Gegenbauer integration method to e^+e^- annihilation process, 8:13270 (R;DE)
Lancaster, H., *See* Abbott, S., 8:12896
Landis, D.A., *See* Goulding, F.S., 8:13443
Landram, C.S., *See* McMaster, W.H., 8:12420
Lane, A.T., Some aspects of utility obligation to serve new retail loads, 8:12501 (R;US)
Lane, K., *See* Bulos, F., 8:12897
Lane, S.L., *See* Attwood, D.T., 8:13528
Lang, D.L., Moving coal by rail, 8:11744 (RA;US)
Lange, R., *See* Gudiksen, P., 8:13196
Langmuir, D., *See* Muller, A.B., 8:11909
Langmuir, M.E., Laser spot scanning of photoelectrochemical cells. Technical report, 8:12023 (R;US)
Lanier, W., *See* Richey, W.M., 8:12549
Lankford, J. Jr., *See* Page, R.A., 8:12709
Lapedes, A., Another gravitational instability of flat space-time, 8:13410 (J;NL)
Larkins, P.R., Outlook for synthetic fuels, 8:12496 (RA;US)
Larrabee, D.A., *See* Jardin, S.C., 8:13510
Larrabee, R.D., *See* Thurber, W.R., 8:12885
Larsen, J.T., *See* Attwood, D.T., 8:13528
Larsen, P.O., Amino acid synthesis in photosynthesizing spinach cells: effects of ammonia on pool sizes and rates of labeling from $^{14}CO_2$, 8:13122 (J;US)
Larsson, E., Demo plant for the production of fermentation ethanol for the motor fuel market in Sweden, 8:12030 (RA;BR)
Latorre, V.R., Fuel-cell technology assessment. Volume I. The potential value of US fuel-cell technology in foreign countries, 8:12526 (R;US)
Fuel-cell technology assessment. Volume II. Evaluation of Japan, 8:12527 (R;US)
Fuel-cell technology assessment. Volume III. Evaluation of Tunisia, 8:12528 (R;US)
Fuel-cell technology assessment. Volume IV. Evaluation of Taiwan, 8:12529 (R;US)
Fuel-cell technology assessment. Volume V. Evaluation of South Korea, 8:12530 (R;US)
Lau, A., Uses and abuses of f-chart, 8:12146 (RA;US)
Lau, F.S., *See* Wall, B.D., 8:11608
Lau, H.J., Partial cross sections and density of states effects in the valence band photoemission from solid nitrogen, 8:12732 (R;DE)
Laughlin, J.S., Biological and clinical dosimetry. Comprehensive eighteen-year report, July 1, 1964-June 30, 1982, 8:13380 (R;US)
Laurer, G.R., *See* Cohen, N., 8:13401
LaVake, J.C., High-burnup PWR ramp test program. Background topical report, Petten ramp test results, 8:12303 (R;US)
Laval, H., CONVEC: a computer program for transient incompressible fluid flow based on quadratic finite elements. Part I. Theoretical aspects, 8:12868 (R;XE)
CONVEC: a computer program for transient incompressible fluid flow based on quadratic finite elements. Part 1: theoretical aspects, 8:13248 (R;XE)
Law, C.K., *See* Kerstein, A.R., 8:12834
Lawrence, R.D., *See* Kienle, C.F., 8:13207
Layman, W.H., *See* Chexal, V.K., 8:12425
Le Boutellier, J.P., Suction trenching, and the use of fly ash for backfilling, 8:11822 (TJ;GB)
Leach, H.J., *See* Shackson, R.H., 8:12612
Leatherman, G.L., Examination of the growth of NiO on Ni using magnetic-resonance techniques, 8:12666 (R;US)
Leavesley, P.J., *See* Dobie, M.J., 8:12720
Lebech, B., Structure of NdF_3, 8:12777 (RA;DK;In Danish)
Structures of ytterbium-dihydride, 8:12779 (RA;DK;In Danish)
See Staun Olsen, J., 8:12778
Lee, E.P., Gaussian-profile beams, 8:12908 (R;US)
Lee, G.K., Canadian low-rank coals: resources, conversion and utilization, 8:11722 (RA;US)
Lee, J.C., *See* Komoriya, H., 8:12380
Lee, L., *See* Pfenning, K.J., 8:12797
Lee, L.J., *See* Guven, N., 8:12249
Lee, M.L., *See* Jackson, W.P., 8:12750
Lee, S.Y., Present municipal water treatment and potential removal methods, 8:13086 (RA;US)
See Drury, J.S., 8:13084
Lee, Y.Y., Workshop on acceleration of polarized protons: summary report, 8:12899 (R;US)
Leemann, C.W., *See* Lambertson, G.R., 8:12907
Legassie, R.W.A., Coal: the refocused federal program, 8:11581 (RA;US)
Synfuels and electricity from coal: DOE's refocus on R & D, 8:12486 (RA;US)
Legge, R., *See* Sarma, K.R., 8:12098
Lehmann, E., *See* Hohmuth, K., 8:12472
Lehmberg, R.H., Numerical study of phase conjugation in stimulated Brillouin scattering from an optical waveguide, 8:13488 (R;US)
See Stamper, J.A., 8:13524
Leibowitz, L., *See* Green, D.W., 8:12718
Leininger, M., Structural analysis of the CDF transporter cart, 8:12917 (R;US)
Leitz, F.J., *See* Gold, R., 8:12398
Lemasle, J.M., *See* Chrysostome, G., 8:11967
Lemmel, H.D., Index of nuclear data libraries available from the IAEA Nuclear Data Section, 8:13571 (R;XA)
Lemming, J.F., *See* Anderson, M.E., 8:11940
Lemon, D.K., *See* Collins, H.D., 8:12881
Lemon, G.D., *See* Orr, H.D., 8:12850
Lenard, M.L., Randomly generated test problems for positive definite quadratic programming, 8:13537 (R;US)
Lengeler, B., Double excitation structure in the L-edge X-ray absorption spectra of α-cerium, 8:12662 (R;DE)
Leon, E.M., *See* Hamstad, M.A., 8:12701
Leonard, J.A., Shenandoah Solar Total-Energy Project, 8:12122 (R;US)

Leonard, R.L., Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA;US)
Lepage, C.A., *See* Cameron, C.C., 8:11708
LePori, W.A., *See* Engler, C.R., 8:12102
Lepper, F., *See* Deutsch, R., 8:13428
Lesiecki, H., *See* Alberts, W.G., 8:12956
See Klein, H., 8:12961
Lesko, K.T., *See* Norman, E.B., 8:13227
Leskovar, B., *See* Turko, B., 8:13183
Lester, F.W., *See* Bufe, C.G., 8:12193
Leva, D., Transco medium-Btu lignite gasification project, 8:11650 (RA;US)
Levin, B., Survey of the international development in indoor climate control, 8:12564 (R;US)
Levin, L.I., *See* Selvin, S., 8:13138
Levine, N., Survey of manufacturers of solar-thermal-energy systems, 8:12179 (R;US)
Levins, W.P., Measured effect of forced ventilation on house infiltration rate, 8:12559 (R;US)
Levy, J.A. Jr., Acid deposition in Texas: technical summary and perspective. Final report, 8:13033 (R;US)
Plan to evaluate acid-deposition issues in the state of Texas. Final report, 8:13032 (R;US)
Levy, P.F., Alkaline oxidation of peat, 8:11668 (RA;US)
Levy, P.W., Characteristics of thermoluminescence glow curves for materials exhibiting more than one glow peak, 8:12818 (R;US)
See Schwartzman, R.G., 8:13216
Levy, S., New method using anhydrous [^{18}F]fluoride to radiolabel 2-[^{18}F]fluoro-2-deoxy-D-glucose, 8:12826 (J;US)
Levy, S.I., Thermophotovoltaic conversion from conventional heat sources. Final report, 8:12546 (R;US)
Lewis, B.E., Evaluation of a heat exchanger for use in the Integrated Equipment Test facility solvent-extraction system, 8:11848 (R;US)
Lewis, D.A., Sizes and shapes of short-lived nuclei via laser spectroscopy. Progress report, January 31, 1981-July 31, 1982, 8:12916 (R;US)
Lewis, E.L., Pelletized waste form demonstration program, April-September 1982, 8:11890 (R;US)
Lewis, J.C., *See* Cook, K.V., 8:13493
Lewis, M.F., *See* Gehri, D.C., 8:11686
Ley, R.D., *See* Kuemmerle, N.B., 8:13168
See Webb, R.B., 8:13164
Leysen, R., *See* Vandenborre, H., 8:11954
Li, D.W., *See* Moyzis, R.K., 8:13114, 8:13115
Liss, S.G., *See* Rosenstock, H.M., 8:12809
Liauh, W.C., Investigation of the inaccessible pore volume phenomena, 8:11804 (J;US)
Libicki, J., *See* Stefanski, M.J., 8:11734
Lietzke, A.F., *See* Jackson, G.L., 8:13479
Lihach, N., Plant construction and community stress, 8:12509 (J;US)
Lin, L.Z., *See* Turowski, P., 8:12848
Lin, M.C., Moessbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces, 8:12675 (R;US)
Lin, R.J.H., *See* McChesney, M.A., 8:12176
Lindenbaum, S.J., Evidence for glueballs, 8:13267 (R;US)
Lindsey, G., Phase I report: inventory of potential small-scale hydropower sites in Illinois and selection of projects exhibiting potential for development. Final report, 8:11994 (R;US)
Small scale hydropower development in Illinois: an implementation manual. Final report, 8:11993 (R;US)
Lindsey, H., *See* Herlevich, A., 8:11956
Lindstrom, O., Peat research and development in Sweden, 8:11750 (RA;US)
Lindstrom, R.S., *See* Athens, P., 8:13027
Lineback, N.G., Land use/mineral rights map series, 8:13072 (R;US)
Linford, R.K., *See* Barnes, C.W., 8:13438
See Spencer, R.L., 8:13442
Lippelt, I.D., *See* Madison, F.W., 8:11715
Littlefield, R.J., Use of color and motion for the display of multi-dimensional data, 8:13559 (R;US)
Littlejohn, D., Kintic study of ferrous nitrosyl complexes, 8:12800 (J;US)
Liu, A.Y., *See* Rousseau, J., 8:12167
Livingston, R.S., Desirable energy future: a national perspective, 8:12490 (B;US)
Livni, E., *See* Levy, S., 8:12826
Ljungdahl, L.G., Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms, 8:13135 (BA;US)
Lloyd, W.G., Predictors of plasticity in bituminous coals. Technical progress report No. 5, 8:11672 (R;US)
Loehman, R.E., *See* Beauchamp, E.K., 8:12715
Loehner, H., *See* Gutbrod, H.H., 8:13297
Loevseth, J., *See* Brevik, I., 8:12003
Loffler, F., Geodetic control surveys at PETRA, 1981/1982, 8:12941 (TG;US)
Lofgren, B.E., Monitoring crustal deformation in the Geysers-Clear Lake region, 8:12237 (RA;US)
Logan, B.G., *See* Henning, C.D., 8:13468
Logan, T.L., *See* Huning, J.R., 8:12012
Logel, J.D., *See* Van Eck, O.J., 8:13211
Logg, C.A., I/O register to FASTBUS interface, 8:13564 (R;US)
Lojek, D., *See* Ciliberti, D.F., 8:11627
Lomachenkov, I.A., *See* Vakhtel', V.M., 8:13345
Lomenick, T.F., Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R;US)
Longanbach, J.R., Heavy recycle-solvent studies in two-stage coal liquefaction. Second technical progress report, October 1-December 10, 1982, 8:11643 (R;US)
Lopez, B., *See* Hull, K., 8:12946
Lorek, G., Development of new combustion control equipment. Application to a modern range of gas burners and the resulting savings. The move towards permanent closed loop combustion control, 8:12893 (TG;GB)
Lott, D.F., Calibration of sonic flowmeters for Ocean Thermal Energy Conversion (OTEC), 8:12131 (R;US)
Heat exchanger cleaning in support of ocean thermal energy conversion (OTEC) - electronics subsystems, 8:12129 (R;US)
Heat exchanger cleaning in support of ocean thermal energy conversion (OTEC) - mechanical subsystem, 8:12130 (R;US)
Lott, L.A., Ultrasonic detection of molten/solid interfaces of weld pools, 8:12670 (R;US)
See Barna, B.A., 8:12879
Loute, E., *See* Ho, J.K., 8:13570
Lovati, A., Reliability studies applied to plant safety, 8:12884 (TJ;GB)
Lovchikova, G.N., *See* Dovbenko, A.G., 8:13324
Loveless, H.J. Jr., Energy diversion: theft of electricity, 8:12498 (R;US)
Lovell, H.L., *See* Given, P.H., 8:11613
Lovell, R.T., *See* Duke, W.L., 8:12856
Lovett, G.M., Cloud water: an important vector of atmospheric deposition, 8:13020 (R;US)
Lowry, M.E., Magnetic-resonance studies of reactively sputtered amorphous silicon-hydrogen alloys, 8:12739 (R;US)
Lu, F., *See* Cross, W.H., 8:11684
Lu, L.T., Spin-lattice relaxation of protons in scandium dihydride, 8:12713 (R;US)
Lubell, M.S., *See* Haubenreich, P.N., 8:13503
Lucas, A.C., Use of a helium-3 filled proportional counter as a sensitive dose or dose equivalent meter, 8:12960 (RA;DE)
Luccio, A., One-dimensional numerical simulation of a free-electron laser - storage-ring system, 8:12864 (R;US)
See Krinsky, S., 8:12937
Ludemann, C.A., *See* Casstevens, B.J., 8:12930
Ludlam, T., *See* Kraner, H.W., 8:12943
Ludlow, J., Conceptual designs for peat production systems, 8:11728 (RA;US)
Ludwig, E.J., *See* Wilkerson, J.F., 8:12915
Ludwin, R.S., *See* Bufe, C.G., 8:12193
Lugenheim, V., *See* Javeri, V., 8:12395
Luk'yanov, A.A., *See* Komarov, A.V., 8:13376
Lukens, L.L., Nuclear power plant electrical cable damageability experiments, 8:12351 (R;US)
Lukhanin, A.A., *See* Derkach, A.Ya., 8:12924
Luly, M.H., Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_8Mo_2Cl_8H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters, 8:12785 (R;US)
Luna, R.E., *See* Sandoval, R.P., 8:11862
Lunev, V.P., *See* Dovbenko, A.G., 8:13324
Lupa, A.J., Simulation of a Texaco gasifier. Volume 2: an unsteady-state model. Final report, 8:11648 (R;US)
Lusas, E.W., *See* Engler, C.R., 8:12102
Luykx, F., Radioactive effluents from nuclear power stations in the European Community, 1974-1978, 8:12368 (J;US)
Lynch, W.G., Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R;US)
Lyon, W.S., Paper prediction versus reality at the 1981 Modern Trends in

Activation Analysis Conference, 8:12763 (J;CH)
Lyons, J.A., Canadian seismic agreement. Annual report, 1 July 1981 to 30 June 1982, 8:13210 (R;US)

M

Maccarrone, G.D., *See* Barut, A., 8:13406
MacCrone, R.K., Protective oxide films. Progress report, 8:12665 (R;US)
See Berndt, C.C., 8:12708
See Leatherman, G.L., 8:12666
MacDonald, P.E., *See* Cronenberg, A.W., 8:12414
MacGill, R., *See* Abbott, S., 8:12896
Madden, K.P., ESR study of the attack of photolytically produced hydroxyl radicals on α-methyl-D-glucopyranoside in aqueous solution, 8:12822 (J;US)
Madden, N.W., *See* Goulding, F.S., 8:13443
Madison, F.W., Peat resource assessment in Wisconsin, 8:11715 (RA;US)
Madrid, M.A., *See* Grisham, D.L., 8:12443
Maeda, M., Neutron-shielding material. Translated from the Japanese, 8:13374 (R;US)
Maehara, H., *See* Tamiya, K., 8:12702
Mafra, O.Y., *See* Paschoa, A.S., 8:12761
Mahaffey, J.A., *See* Ragan, H.A., 8:13149
See Rhoads, K., 8:13165
Mahajan, S.M., Linear theory of electromagnetic instabilities in plasmas with a hollow q-profile, 8:13453 (J;AT)
Mahathy, J.M., DOT's proposed routing for radioactive material shipments, 8:12858 (J;US)
Maheshwari, A., Three-particle relativistic harmonic dynamics in the constraint formalism, 8:13279 (R;JP)
Maheshwari, N., *See* Jones, J.W., 8:12580
Mahoney, J.A., Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.1, 8:11629 (R;US)
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.2, 8:11630 (R;US)
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No. 3, 8:11631 (R;US)
Coal-liquefaction catalyst development. Annual report No. 1, April 1, 1979-June 30, 1980, 8:11617 (R;US)
Maier, M.R., Simple multifunction discriminator for multichannel triggers, 8:12973 (R;US)
Maier, R.W., Refinery energy profile. Final report, 8:11808 (R;US)
Majewski, C., *See* Kukiel, E., 8:13173
Makaryunas, K.V., *See* Boruta, I.I., 8:13330
Mal'tsev, A.P., *See* Glazov, A.A., 8:12895
Malachesky, P.A., Design of bipolar, flowing-electrolyte zinc-bromine electric-vehicle-battery systems, 8:12651 (R;US)
Malhotra, P.K., Transverse momentum spectra of dimuons produced in hadronic interactions and comparison with QCD, 8:13259 (R;US)
Mali, M., *See* Brinkmann, D., 8:12698
Malliah, K.T.U., Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals, 8:11725 (RA;US)
Maloeuvre, Michel, Tools for developing software for different types of microprocessors, to be used, in particular, for the acquisition and processing of nuclear data, 8:13542 (R;FR;In French)
Malov, L.A., Description of giant resonance decay in quasi particle-phonon model, 8:13337 (RA;SU;In Russian)
Fragmentation of the few quasiparticle components in the deformed nuclei, 8:13338 (RA;SU;In Russian)
Malovrh, J., *See* Claytor, T.N., 8:12378
Malterer, T.J., *See* Asmussen, D., 8:11696
Malyarzh, E.I., Two-particle electro-disintegration of ^{3}He in a microscopic approach, 8:13301 (RA;SU;In Russian)
Malyshev, I.F., *See* Akulova, N.V., 8:12827
Mandrekas, J., *See* Stygar, W., 8:13502
Manes, A., Optimum exposure of solar collectors with respect to atmospheric transmission of solar radiation, 8:12006 (RA;CH)
Wind power potential in Israel and the eastern Mediterranean, 8:12257 (RA;CH)
Manev, E.D., *See* Celik, M.S., 8:12801
Mangeng, C., *See* Kirschner, C., 8:12160
Manhart, R.L., Tonopah Test Range capabilities: technical manual, 8:13014 (R;US)
Manheimer, W.H., *See* Emery, M.H., 8:13487
Manheimer, W.M., *See* Stamper, J.A., 8:13524
Manickam, J., *See* Tang, W.M., 8:13508
Manikopoulos, C.N., Cesium-plasma-conductivity enhancement in the advanced thermionic energy converter. Final report, 8:12517 (R;US)
Mankinen, E.A., Paleomagnetism of the Clear Lake Volcanics and new limits on the age of the Jaramillo normal-polarity event, 8:12192 (RA;US)
Mankinen, G.W., Comprehensive use of peat in the USSR, 8:11727 (RA;US)
Mann, G.W., *See* Morris, J.A., 8:12099
Mansur, L.K., Theoretical relationships between creep and swelling by point defect absorption during irradiation, 8:12660 (R;US)
Manturov, G.N., Analysis of the average ^{235}U, ^{238}U and ^{239}Pu fission cross sections on ^{235}U and ^{252}Cf fission neutron spectra, 8:13351 (RA;SU;In Russian)
Marbury, F., Least-energy operation of river shipping, 8:12588 (RA;US)
Marchand, Patrick, Measurement methods for high energy particle identification in gaseous mixture detectors, 8:12972 (R;FR;In French)
Marcus, R.A., *See* Noid, D.W., 8:13412
Mardian, J.K., *See* Uberbacher, E.C., 8:13105
Margoliash, E., *See* Shelnutt, J.A., 8:12812
Margolies, D., Changing MFTF vacuum environment, 8:13498 (R;US)
Marino, E.A., *See* Serra, C.E., 8:12037
Markakis, J., *See* Beyerle, A., 8:12731
See Hull, K., 8:12946
Markle, D., *See* Huck, R.W., 8:11693
Marks, S.M., *See* Bufe, C.G., 8:12193
Marlow, W.H., Long-range interaction of small soot particles, 8:13018 (R;US)
Marshall, J., *See* Hoida, H.W., 8:13437
Marshall, J.S., *See* Jensen, A.L., 8:13159
Marshans, M.E., Solar-heated greenhouse utilizing water reservoir. Final technical progress report. Appropriate-Technology Small-Grants Program, 8:12157 (R;US)
Martin, H.L., Advanced servomanipulator performance summary. Consolidated Fuel-Reprocessing Program, 8:12843 (R;US)
Consolidated Fuel-Reprocessing Program. Servomanipulator control systems, 8:12840 (R;US)
Servomotor test stand. Consolidated Fuel-Reprocessing Program, 8:12844 (R;US)
Martin, W.R., *See* Komoriya, H., 8:12380
Martinez, R., Predictions of low-frequency sound from the MOD-1 wind turbine, 8:12260 (R;US)
Martinez, T.M., Impact of energy pricing upon the Hispanic community, 8:12464 (R;US)
Martins, J.B., *See* Knoefell, T.M.J., 8:12944
Maru, H.C., Fuel cell systems and potential applications, 8:12533 (BA;US)
Marx, W.B., Regulatory constraints on industrial coal utilization, 8:11764 (RA;US)
Masciantonio, P.X., Alternatives of the industrial energy planner, 8:12616 (RA;US)
Masker, W.E., *See* Kuemmerle, N.B., 8:13168
Mason, R.J., Electron transport effects in laser produced plasmas, 8:13525 (BA;US)
Massaro, S.A., Power reactor events, 8:12409 (R;US)
Massimilla, L., Carbon attrition during the fluidized combustion and gasification of coal. Quarterly technical progress report, 1 June 1982-31 August 1982, 8:11767 (R;US)
Masson, L.S., *See* Spampinato, P.T., 8:13465
Masterov, V.S., Effect of zero collective oscillations on observed nuclear properties, 8:13366 (RA;SU;In Russian)
Mateja, J.F., Nuclear physics research. Progress report, April 1, 1982-March 31, 1983, 8:13302 (R;US)
Materlik, G., *See* Lengeler, B., 8:12662
Mathews, G.J., *See* Haight, R.C., 8:12909
Mathur, A.K., *See* Phillips, S.L., 8:12252
Matney, T.S., *See* Nguyen, T.V., 8:13130
Matoney, J.P., *See* Albrecht, M.C., 8:11741
Matos, J.E., *See* Daly, T.A., 8:12373
Matranga, V.A., *See* Tancredi, J.J., 8:13489
Matseika, K.Yu., *See* Vainoris, Z.A., 8:12889, 8:12890
Matthews, D.M., *See* Attwood, D.T., 8:13528
Matthews, M.L., Remedial actions at inactive uranium mill tailings sites, 8:11920 (BA;US)

Matveev, V.I., *See* Kujal, J., 8:12321
Matzke, M., *See* Alberts, W.G., 8:12956
Mauch, M.L., *See* Kalkwarf, D.R., 8:13151
Maudlin, P.J., Analysis of LWR degraded core accidents, 8:12435 (J;US)
Maumer, L.F., Production of spallation radionuclides for medical applications at BLIP, 8:12912 (R;US)
May, R.A., Analysis and model testing of a Super Tiger Type B Waste transport system in accident environments, 8:12863 (J;US)
Maya, L., *See* Bennett, M.R., 8:12808
Mayer, D.W., Multidimensional simulation of radon diffusion through earthen covers, 8:11922 (R;US)
Mayer, G.G., Overview of state peat resource programs, 8:11701 (RA;US)
Mayerhoffer, K., *See* Salzmann, H., 8:13427
Mayfield, M.J., Tennessee Valley Authority's atmospheric fluidized bed combustion program, 8:11759 (RA;US)
Mayron, L.W., *See* Kaplan, E., 8:13133
Mays, G.T., Events resulting in reactor shutdown and their causes, 8:12426 (J;US)
Mazzucato, E., *See* Strachan, J.D., 8:13501
McBreen, J., Zinc-electrode morphology in acid-battery electrolytes, 8:12458 (R;US)
See O'Grady, W.E., 8:12520
McCabe, L.P., *See* Caskey, G.R. Jr., 8:12669
McCafferty, T.W., *See* Walke, W.C., 8:12449
McCarley, R.E., Halide and chalcogenide clusters of the early transition metals, 8:12784 (R;US)
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R;US)
McCarthy, A.L., Waves and plasmaheating, 8:13430 (RA;DE;In German)
McCaslin, J.B., *See* Geaga, J.V., 8:13313
McChesney, M.A., Optimization of solar-selective paint coatings. Final report, September 15, 1980-June 15, 1982, 8:12176 (R;US)
McClelland, J.B., *See* Geaga, J.V., 8:13313
McCleskey, J., Synthetic fuels: past performance and future plans, 8:12493 (RA;US)
McClung, R.W., *See* Cook, K.V., 8:13493
McClurg, J.E., *See* Youngberg, A.D., 8:11623
McClurkin, J.L., *See* Taylor, D.S., 8:12446
McCullagh, C.M., GAUSS VII: a computer program for the analysis of γ-ray spectra from Ge semiconductor spectrometers, 8:12948 (R;US)
McCullough, G.R., Shell coal gasification process, 8:11585 (RA;US)
McCurdy, G., Potential synergisms resulting from the use of methanol in gasoline, 8:11969 (RA;US)
McDaniel, E.W., *See* Morgan, M.T., 8:11866
McDonald, S.L., Incidence and effects of a windfall profit tax on natural gas, 8:11819 (R;US)
McDonell, W.R., *See* Hoisington, J.E., 8:11951
McElroy, D.L., In-situ study of attic loose-fill thermal insulation in residential application, 8:12558 (R;US)
McElroy, W.N., *See* Gold, R., 8:12398
McFarland, R.D., *See* Jones, R.W., 8:12162
McFarlane, R.W., Occurrence of American shad eggs in 1G cooling-water canal, 8:13096 (R;US)
McGavran, L.P., LAMAP, the Los Alamos National Laboratory mapping code, 8:13554 (R;US)
McGee, M.J., *See* Fassbender, A.G., 8:12625
McGlynn, S.P., *See* Hochmann, P., 8:13246
McGowin, C.R., Technical and economic aspects of a lignite-fired AFBC boiler, 8:11768 (RA;US)
McGrath, P., *See* Baum, B., 8:12119
McHatton, R.C., Kinetics and mechanisms of the reactions of aliphatic free radicals with organocobaloximes and fluoropentaamminecobalt(III) ion, and of iron(III) with methylrhodoxime, 8:12789 (R;US)
McIlrath, T.J., Laser techniques for extreme ultraviolet spectroscopy, 8:13245 (B;US)
McIntosh, G., *See* Sarma, K.R., 8:12098
McIntyre, P.M., Annual progress report for the high-energy-physics program at Texas A and M University, December 1, 1981-December 1, 1982, 8:12947 (R;US)
McKay, D.C., *See* McKay, G.A., 8:12001, 8:12002
McKay, G.A., Climate and energy, 8:12001 (RA;CH)
Climate data for energy programmes, 8:12002 (RA;CH)
McKay, R.L., Forward dimuons from πN interactions at Fermilab: design and construction of a scintillation-counter hodoscope, 8:13278 (R;US)
McKelvey, T., Graphite limiter and armor damage in Doublet III, 8:13476 (R;US)
McKenna, K.F., FRC confinement studies in FRX-C, 8:13441 (R;US)
McKenzie, D.H., *See* Kennedy, W.E. Jr., 8:11901
McKinley, B.M., *See* Cady, W.E., 8:12727
McLaughlin, J.E., *See* Hajnal, F., 8:12989
McLaughlin, R.J., Research in the Geysers-Clear Lake geothermal area, northern California, 8:12187 (R;US)
Tectonic setting of pre-tertiary rocks and its relation to geothermal resources in the Geysers-Clear Lake area, 8:12188 (RA;US)
McLean, W.J., *See* Mitchell, R.E., 8:11771, 8:11815
McLeod, K.W., *See* Corey, J.C., 8:13067
McMaster, W.H., Fluid-structure-coupling algorithm, 8:12420 (R;US)
McMurray, B.J., *See* Berry, J.R., 8:13146
McNamara, J.J., Legal and institutional overview: by land and air - the struggle continues, 8:12220 (RA;US)
McNatt, F.G., Savannah River Plant waste-tank inspection manual, 8:11881 (R;US)
McNeese, L.E., Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R;US)
McNeil, R.I., *See* Cronauer, D.C., 8:11628
McWilliams, B.M., *See* Herman, I.P., 8:12887
Meadows, J.W., Fission-fragment angular distributions and total kinetic energies for $^{235}U(n,f)$ from .18 to 8.83 MeV, 8:13348 (R;US)
Means, J.L., Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R;US)
Mechlin, G., Seven technologies for the eighties, 8:12470 (R;US)
Mecozzi, D., *See* Athey, C. III, 8:13567
Medugno, C.C., *See* Senise, J.T., 8:12036
Mehnert, R., *See* Brede, O., 8:12743, 8:13242
Mei, H.T., Residential comfort-conditioning options for the Texas Gulf Coast. Final report, 8:12577 (R;US)
Mei, V.C., Short-tube refrigerant-flow restrictors, 8:12556 (R;US)
Meier, K., *See* Bartel, W., 8:13256
Melikian, G., *See* Ezzat-Khalifa, H., 8:12164
Meller, E., Buckling of steel containment shells. Task 1b. Buckling of Washington Public Power Supply Systems' plant No. 2 containment vessel. Final report, 25 August 1980-30 September 1982, 8:12296 (R;US)
Buckling of steel containment shells. Task 1a. Dynamic response and buckling of offshore power systems' floating nuclear plant containment vessel. Final report, 25 August 1980-30 September 1982, 8:12350 (R;US)
Meneguim, M.A., *See* Serra, C.E., 8:12037
Meng, J., Controlling a radially-connected array of minicomputers, 8:13555 (R;US)
Menlove, H.O., Inventory-sample coincidence-counter manual, 8:11939 (R;US)
Menon, S.V.G., Iterative solutions of finite difference diffusion equations, 8:12338 (R;IN)
Mensinger, M.C., Peat pretreatment: High-pressure wet carbonization, 8:11603 (RA;US)
See Paganessi, J.E., 8:11602
Menze, V.H., *See* Gehri, D.C., 8:11686
Mercer, J.W., Parameters and variables appearing in repository-siting models, 8:11891 (R;US)
Mercier, M.T., Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R;US)
Merrill, D.T., Application of ozone to eliminate tertiary treatment of wastewater used for industrial cooling. Final technical report, 8:12624 (R;US)
Merrill, D.W., *See* Selvin, S., 8:13138
Merte, H. Jr., Boiling in narrow crevices in steam generators. Final report, 8:12305 (R;US)
Merz, E., *See* Odoj, R., 8:11888
Merzbacher, E., Theory of Coulomb excitation and ionization, 8:13236 (R;US)
Mesmer, R.E., *See* Patterson, C.S., 8:12254
Metcalf, W., *See* Chan, L.H., 8:13250
Metcalfe, L.J., *See* Cheng, T.C., 8:12412
Meurant, G., Numerical solution of large sparse linear systems, 8:13541 (R;FR;In French)

Meyer, R.A., *See* Williams, R.E., 8:12767
Michaels, H.J., *See* Dokuzoguz, H.Z., 8:11586
See Oster, L.A., 8:11659
Michaelson, S.M., Health implications of exposure to radiofrequency/ microwave energies, 8:13195 (J;GB)
Micheels, R.H., *See* Langmuir, M.E., 8:12023
Michelson, D., *See* Drury, J.S., 8:13084, 8:13085
Michie, R.B., Simplifying theorem for analyzing rf antennas with feeders, 8:13475 (R;US)
Micklich, B.J., Maximum tritium production in toroidal fusion reactors with no inboad breeding, 8:13518 (J;US)
Mientek, A.P., On-site fuel cell power plant technology development program. Annual report Jan 81-Dec 81, 8:12523 (R;US)
Mikhajlov, I.N., *See* Brianson, Sh.I., 8:13357
Mikhajlov, V.D., *See* Bortnyanskij, A.L., 8:12928
Mikhajlov, V.M., Description of rotation using of collective bosons with Ksup(π)=Isup(+) momentum projection, 8:13369 (RA;SU;In Russian)
See Efimov, A.D., 8:13367
Mikkelsen, D., *See* Post, D., 8:13450
Mikosch, F., *See* Becker, E.W., 8:11843
Milek, H.F., *See* Brak, S.B., 8:12861
Miles, J.S., SDG and E solar heating system data reduction and analysis techniques, 8:12136 (RA;US)
Miles, K.J., Gamma emmission tomography of irradiated fuel bundles, 8:12360 (J;US)
Miles, T.R., Preparation of biomass for gasification, 8:12089 (RA;US)
Milewski, J.V., Problems and solutions in using short fiber reinforcements, 8:12721 (BA;US)
Miley, G.H., An FRTP fusion ignition experiment, 8:13522 (J;US)
Burn dynamic experiment based on the field-reversed theta pinch, 8:13466 (R;US)
See Hsiao, M.Y., 8:13419
See Olson, R.E., 8:13420
Millemann, R.E., Enhanced oil recovery: environmental issues and state regulatory programs, 8:13063 (J;GB)
Miller, C.A., Liquid crystals and microemulsions in oil recovery, 8:11801 (J;US)
Miller, D.E., *See* Griffith, R.V., 8:12982
Miller, G.K., Safety analysis of Kuosheng Mark III SRV piping response to discharge loading, 8:12289 (R;US)
Miller, J.A., Toward a comprehensive chemical kinetic mechanism for the oxidation of acetylene: comparison of model predictions with results from flame and shock tube experiments, 8:11965 (RA;US)
Miller, N.E., *See* Wurm, K.J., 8:11895
Miller, P.D., *See* Bair, J.K., 8:13314
Miller, R.W., *See* Buescher, B.J., 8:12434
Miller, W.A., Laboratory evaluation of the heating capacity and efficiency of a high-efficiency, air-to-air heat pump with emphasis on frosting/defrosting operation, 8:12563 (R;US)
Miller, W.G., *See* Puig, J.E., 8:11800
Milligan, D.J., *See* Morris, J.A., 8:12099
Mills, J.B., *See* Bjornstad, D.J., 8:12065
Milne, T.A., Fundamental pyrolysis studies, 8:12076 (RA;US)
Milos, F.S., *See* Wasan, D.T, 8:11805
Mings, W.J., *See* Cheng, T.C., 8:12412
Minkoff, M., *See* Lenard, M.L., 8:13537
Minton, J., *See* Athey, C. III, 8:13567
Mirantsev, L.V., *See* Nadzhafov, I.M., 8:13262
Mirkovich, V.V., Measurement of thermal diffusivity of rocks at high pressure, 8:13221 (R;US)
Mishima, J., *See* Owzarski, P.C., 8:11860
Misra, B., Thermal-hydraulics design considerations for the STARFIRE-DEMO breeding blanket, 8:13516 (J;US)
Mitchell, D.H., *See* Mudge, L.K., 8:12067
Mitchell, R.E., On the temperature and reaction rate of burning pulverized fuels, 8:11815 (RA;US)
Temperature and reaction rate of burning pulverized fuels, 8:11771 (R;US)
See Miller, J.A., 8:11965
Mitina, G.A., *See* Kal'ner, V.D., 8:12672
Mitra, S.P., *See* Samanta, P.K., 8:12433
Mitsche, J., *See* Douglas, J., 8:12286
Mittal, R.K., Effects of energy constraints on transportation systems: proceedings of the fifth national conference, 8:12582 (R;US)
Energy intensity of various transportation modes, 8:12611 (RA;US)
Mittwede, H., Nashville Electric Service cogeneration energy-recovery facility, 8:12626 (R;US)
Moan, K.L., Evaluation of SUNPACK tube vacuum quality. Final report, 1 September 1978-31 May 1980, 8:12177 (R;US)
Moellenbach, K., *See* Busch, N.E., 8:12108
Moeller, C.P., Mode converters used in the Doublet III ech microwave system, 8:13477 (R;US)
Moen, D.E., *See* Hickok, W.W., 8:11756
Mogk, J.E., Peat resource estimate in Michigan, 8:11709 (RA;US)
State resource estimation: Michigan, 8:11695 (RA;US)
Mohr, C.L., LOCA simulation in NRU program. Data report for thermal-hydraulic experiment 2 (TH-2), 8:12411 (R;US)
Moiseev, V.Ya., *See* Akulova, N.V., 8:12827
Mok, W.S., Effects of pressure on biomass pyrolysis, 8:12077 (RA;US)
Moll, A.J., *See* Oliver, E.D., 8:11777
Moltz, D.M., *See* Avignone, F.T. III, 8:13000
Moncton, D.E., High-resolution x-ray scattering, 8:12913 (R;US)
Montgomery, D.B., *See* Stacey, W.M. Jr., 8:13480
Montgomery, G.G., *See* Hones, F.I., 8:12275
Montoya, P.C., *See* Viney, C.E., 8:12873
Monts, J.K., Community-Level Impacts Projection System (CLIPS). Final report, 8:12462 (R;US)
Moore, A.T., Designing for energy efficiency: a study of eight Californin state office buildings, 8:12560 (R;US)
Moore, C., *See* Gollon, P.J., 8:12999
Moore, C.W., Ligase-deficient yeast cells exhibit defective DNA rejoining and enhanced gamma ray sensitivity, 8:13160 (J;US)
Moore, D.S., *See* Engler, C.R., 8:12102
Moore, J.G., *See* Morgan, M.T., 8:11866
Moore, R.H., US Uranium Registry tissue program, 8:12828 (BA;US)
Moos, W., *See* Burgkhardt, B., 8:12952
Moraes, V.L.V., *See* Senise, J.T., 8:12036
Moran, K., National conference for bicycle program specialists. Final report, 8:12613 (R;US)
Moreira, A.R., *See* Dale, B.E., 8:11972
Moreira, J.R., Evaluation of energy expenditures in the agricultural phase of some crops, 8:12031 (RA;BR)
Moreland, W.C., Development and demonstration of an electric heat pump for waste-heat recovery in industry. Preliminary design report, 8:12621 (R;US)
See Snyder, P.H., 8:12620
Morgan, M.T., Strontium leachability of hydrofracture grouts for sludge-slurries, 8:11866 (R;US)
Morissette, R.P., Economics of monitored retrievable storage of nuclear wastes, 8:11858 (J;US)
Morosin, B., *See* Beauchamp, E.K., 8:12715
Morozov, N.A., *See* Alenitskij, Yu.G., 8:12902
Morris, C.M., *See* Thompson, A.C., 8:12764
Morris, J.A., Demonstration of solar-energy conversion of agricultural or industrial wastes to fuels. Final report, 8:12099 (R;US)
Morris, W., *See* Bensinger, J., 8:13254
Morse, J.W., *See* Choppin, G.R., 8:13083
Mortensen, G.A., *See* Santee, G.E. Jr., 8:12390
Morton, E.W., Energy-efficient compact screw-in fluorescent lamp. Final report, 8:12562 (R;US)
Morton, P.L., *See* Cooper, R.K., 8:12865
Moseley, P.K., *See* Treat, C.H., 8:12169
Moser, F., *See* McCarthy, A.L., 8:13430
See Raeuchle, E., 8:13425
Moses, J.D., *See* Extermann, R.C., 8:13001
Moshkin, V.N., *See* Akulova, N.V., 8:12827
Mosley, W.C., Surface studies of iridium-alloy grain boundaries associated with weld cracking, 8:11949 (R;US)
Moss, C.E., Gamma rays from the interactions of reactor fast neutrons ordered by increasing gamma-ray energy, 8:13334 (R;US)
Mottier, M., *See* Keizer, R.L., 8:12914
Mottola, E., *See* Lapedes, A., 8:13410
Mouchahoir, G.E., Overview of transportation energy methodologies, 8:12585 (RA;US)
Moujaes, S.F., *See* Ying, D.H.S., 8:11616
Moyzis, R.K., Alternative view of mammalian DNA sequence organization. I. Repetitive sequence interspersion in Syrian hamster DNA: a model system, 8:13114 (J;GB)
Alternative view of mammalian DNA sequence organization. II. Short repetitive sequences are organized into scrambled tandem clusters in Syrian hamster DNA, 8:13115 (J;GB)

Mozer, A., *See* Deutsch, R., 8:13428, 8:13484
Mudge, L.K., Investigation of gasification of biomass in the presence of catalysts, 8:12067 (R;US)
Mueller, G., *See* Wilhelm, R., 8:13426, 8:13431
Mueller, J., Drive for the hf quadrupole structure, 8:12898 (TG;US)
Mueller, J.E., *See* Lengeler, B., 8:12662
Mueller, R.A., Stress analysis for nuclear power plant components, 8:12355 (R;BR)
Mueller, W., *See* Schmitz, V., 8:12877
Muetterties, E.L., *See* Tsai, M.C., 8:12810
Muhlestein, L.D., *See* Jeppson, D.W., 8:13483
Muhr, G., *See* Damerau, G., 8:11885
Mukherjee, A.K., *See* Hamstad, M.A., 8:12701
Mukherjee, S., *See* Miller, C.A., 8:11801
Muller, A., Finite element for plates and shells, 8:12853 (R;BR;In Portuguese)
Muller, A.B., Formulation of an integrated physicochemical-hydrologic model for predicting waste-nuclide retardation in geologic media, 8:11909 (R;US)
Muminov, A.I., Nonadiabatic deviation of E2-transition probabilities in Yb isotopes, 8:13339 (RA;SU;In Russian)
Muniz, A.A., Analysis of minimum operational costs for PWR nuclear power plants, 8:12304 (R;BR;In Portuguese)
Munson, L.F., Comprehensive (MORT based) approach to planning internal decontamination, 8:12418 (R;US)
Pitfalls in air sampling for radioactive particulates, 8:13049 (BA;US)
Munson, L.H., *See* Munson, L.F., 8:13049
Murphy, B.D., *See* Raridon, R.J., 8:13048
Murphy, E.S., Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents, 8:12413 (R;US)
Murzagaliev, G.D., *See* Kozhamkulov, T.A., 8:13359
Muthig, P.J., *See* Ferm, J.C., 8:11717
Myasnikov, Yu.A., *See* Akulova, N.V., 8:12827

N

Nadezhdin, V.S., *See* Golovin, B.M., 8:12970
Nadzhafov, I.M., Effect of the crystal structure of the medium on the evolution of the electromagnetic shower, 8:13262 (RA;SU;In Russian)
Najewicz, D.J., *See* Schnacke, A.W., 8:12524
Nakata, T., *See* Aime, M., 8:12729
Nandi, S.P., *See* Kosowski, G.M., 8:12072
Nanni, H., Use of glow-plugs in order to obtain multifuel capability of diesel engines, 8:12654 (RA;BR)
Narasimhan, T.N., Numerical modeling in hydrology, 8:13205 (J;US)
Physics of saturated-unsaturated subsurface flow, 8:13199 (J;US)
Recent trends in hydrogeology, 8:13198 (B;US)
Naroska, B., *See* Bartel, W., 8:13256
Nasser, M.A., *See* Geaga, J.V., 8:13313
Natale, A.A., Comments on gauge hierarchies, 8:13282 (R;BR)
Natesan, K., *See* Saltelli, A., 8:12693
Natoli, J., *See* Miller, C.A., 8:11801
Natwig, D.L., *See* Abraham, K.M., 8:12456
Naumov, Yu.V., *See* Bykov, A.A., 8:13329, 8:13341
Navratil, G.A., Steady state linear machine for collisionless plasma studies, 8:13459 (J;GB)
Navratil, J.D., Removal of solubilized solvent extractants from aqueous waste streams, 8:11919 (J;JP)
Navrotsky, A., *See* Capobianco, C., 8:13222
Nayak, U.P., *See* Foster, J.P., 8:12359
Needleman, A., *See* Sham, T.L., 8:13402
Nehring, N.L., Gases from springs and wells in the Geysers-Clear Lake area, 8:12211 (RA;US)
Neilson, G.H., *See* Swain, D.W., 8:13505
Nelson, C.A., *See* Kienle, C.F., 8:13207
Nelson, D.B., *See* Cooper, W.A., 8:13523
Nelson, R.A., In situ and laboratory geotechnical test results from borehole GD-1 in southeast Utah, 8:11897 (R;US)
Nelson, S.O., Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen, and vanadium alloys, 8:12712 (R;US)
Nelson, V., Wind-assist irrigation and electrical-power generation. Final report, 8:12266 (R;US)
Nesbitt, S.A., Florida atlas of breeding sites for herons and their allies: 1976-1978, 8:13055 (R;US)
Nesterenko, V.O., *See* Karpeshin, F.F., 8:13241
See Solov'ev, V.G., 8:13356
Neto, A.O.B., *See* Doin, P.A., 8:12038
Neton, J.W., *See* Cohen, N., 8:13401
Neudachin, V.G., *See* Kukulin, V.I., 8:13371
Nevald, R., *See* Lebech, B., 8:12777
Newby, K., *See* Malachesky, P.A., 8:12651
Newton, R.J., *See* Goodin, J.R., 8:12101
Nguen Din' Dang, Effect the residual force spin components on the properties of the electrical type states in the spherical nuclei, 8:13326 (RA;SU;In Russian)
Nguyen, K., Classical transport coefficients in a field-reversed configuration, 8:13458 (J;GB)
Nguyen, T.V., Exposure of pharmacy personnel to mutagenic antineoplastic drugs, 8:13130 (R;US)
Nichols, A.V., *See* Hunter, J.A., 8:13109
Nichols, J., *See* Bjornstad, D.J., 8:12065
Nicholson, D.R., *See* Knorr, G.E., 8:13421
See Wang, C.L., 8:13461
Nicholson, R.W., *See* Carden, R.S., 8:12246
Nicholson, W.L., *See* Littlefield, R.J., 8:13559
Nielsen, L., *See* Lebech, B., 8:12777
Nielson, K.K., *See* Kalkwarf, D.R., 8:13151
Nieto, M.M., Coherent states with classical motion: from an analytic method complementary to group theory, 8:13407 (R;US)
Nilmura, M., *See* McCarthy, A.L., 8:13430
Nikolaev, M.A., Total and partial proton widths of the Gamow-Teller resonances, 8:13347 (RA;SU;In Russian)
Nikaa, S., Time-resolved weight loss kinetics for the rapid devolatilization of a bituminous coal, 8:11657 (RA;US)
Nil'asov, B., *See* Kolomiets, V.M., 8:13365
Nilan, R.A., Nature and mechanism of induction of mutations. Annual progress report, October 1, 1981-August 1, 1982, 8:13103 (R;US)
Nimmons, J.T., PURPA benefits for geothermal power producers: assured markets and regulatory exemptions, 8:12223 (RA;US)
Nir, A., Tracer theory with applications in geosciences. Environmental Sciences Division, Publication No. 1964, 8:13197 (R;US)
Nishinomiya, S., Possible effects of solar energy conversion on meteorological conditions, 8:12018 (RA;CH)
Nitsche, H., *See* Edelstein, N., 8:12825
Nitschke, J., *See* Faerber, K., 8:13391
Nobe, K., Design, evaluation, and application of continuous-flow cells for organic electrochemical synthesis. Final report, 8:12814 (R;US)
Noble, I.R., *See* Shugart, H.H. Jr., 8:13057
Noellmann, C., *See* Burgkhardt, B., 8:12954
Nogueira, F.R., *See* Prado, C.P.C. do, 8:12468
Noid, D.W., Calculations related to quantum stochasticity, an example of overlapping avoided crossings, 8:13412 (J;NL)
Nola, S.J., SCE resources in the 1980's, 8:12239 (RA;US)
Noma, H., *See* Avignone, F.T. III, 8:13000
Norman, E.B., ^{7}Be decay scheme and the solar-neutrino problem, 8:13227 (R;US)
Cosmic clocks, 8:13228 (R;US)
Noronha, J.C., Ultra-low IFT, phase behavior and microstructure in oil/brine/surfactant/alcohol systems, 8:11802 (J;US)
Northcutt, K.J., *See* Dyer, F.F., 8:12766
Nouffi, R., Electrochemical photovoltaic cells/stabilization and optimization of II-VI semiconductors. Third technical progress report, 1 October-31 December 1979, 8:12093 (R;US)
Noumachi, M., *See* Snover, K.A., 8:13316
Novozilov, A.I., *See* Kujal, J., 8:12321
Nowicki, L.J., *See* Rothman, S.J., 8:12694
Nugent, J.E., Past, present, and projected energy sources for electrical generation in Texas, 8:11736 (RA;US)

O

O'Brien, G., *See* Herz, J., 8:12118
O'Connell, T.F., Different perspective, 8:12088 (RA;US)
O'Connor, B.H., *See* Thompson, A.C., 8:12764
O'Donnell, F., *See* Hoy, H.C., 8:11931
O'Grady, W.E., Advanced chemistry and materials for fuel cells, 8:12520 (R;US)
O'Neil, D.A., *See* Cohn, J.J., 8:11873
O'Neal, H.P., *See* Hiler, E.A., 8:12103
O'Neal, W.C., *See* Hipple, D.L., 8:11821
O'Neill, G.F., Additional Pu-238 production, 8:11952 (R;US)
O'Neill, L.H., *See* Bartel, W., 8:13256

O'Sullivan, J.B., Role of fuel cells in industrial cogeneration, 8:12542 (BA;US)
Oakes, E.J., Development and commercialization of circulating fluidized bed combustion systems, 8:11765 (RA;US)
Oakes, T.W., *See* Alexander, W.A., 8:13066
Oatman, E.N., *See* Keelin, T.W., 8:12505
Ober, R., Energy conservation - pilot's viewpoint, 8:12608 (RA;US)
Odegard, D.S., Early-life maintenance requirements of 124 HUD-approved SDHW systems installed between 1978 and 1980, 8:12151 (RA;US)
Odoj, R., Proceedings of the international seminar on chemistry and process engineering for high-level liquid waste solidification, 8:11888 (R;DE;In German and English)
Oesterreicher, H., Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga), 8:12697 (J;US)
Ogden, J.C., *See* Nesbitt, S.A., 8:13055
Okhrimenko, I.P., Microscopic description of collective excitations of the ^{44}Ti nuclei in generalized hyperspherical function method, 8:13318 (RA;SU;In Russian)
Olins, D.E., *See* Uberbacher, E.C., 8:13105
Oliveira, C.A.N. de, *See* Paschoa, A.S., 8:12761
Olivent, W.P., *See* Maier, R.W., 8:11808
Oliver, E.D., When should you build a synthetic fuel plant, 8:11777 (RA;US)
Olman, M.D., Quantitative fault tree analysis using the Set Evaluation Program (SEP), 8:13557 (R;US)
Olsen, C.E., *See* Extermann, R.C., 8:13001
Olsen, D., Status of the Minnesota peat inventory project (April, 1982), 8:11710 (RA;US)
Olsen, W.A., *See* Bowen, B.M., 8:13043
Olson, J.H., *See* Gates, B.C., 8:11612, 8:11619
Olson, R.E., Computational simulation of spheromak plasma heating, 8:13420 (R;US)
Olson, R.J., Regional assessment of potential sensitivity of soils in the eastern United States to acid precipitation, 8:13062 (R;US)
Olsson, L.E., *See* Bodin, S., 8:12009
Olszewski, M., *See* Livingston, R.S., 8:12490
Onischak, M., *See* Kosowski, G.M., 8:12072
Onishchenko, L.M., *See* Alenitskij, Yu.G., 8:12902
See Glazov, A.A., 8:12895, 8:12920
Onishi, Y., Mathematical simulation of sediment and radionuclide transport in estuaries, 8:13089 (R;US)
Sediment and radionuclide transport in rivers: radionuclide transport modeling for Cattaraugus and Buttermilk Creeks, New York, 8:13090 (R;US)
Ono, M., *See* Wong, K.L., 8:13447
Ono, Y., Molecular-beam photoionization studies of molecules and their van der Waals clusters, 8:12815 (R;US)
Oothoudt, M.A., ALECS: assembly language extensions and control structures, 8:13551 (R;US)
Oppenheim, J.P., *See* Flumerfelt, R.W., 8:11806
Oppenheimer, D.H., *See* Iyer, H.M., 8:12204
Oppenlaender, T., *See* Deutsch, R., 8:13428, 8:13484
Orava, R., Jets: models versus experimental data, I, 8:13276 (R;US)
Orlov, S.Yu., *See* Bykov, A.A., 8:13329
Orr, H.D., Los Alamos National Laboratory building cost index, 8:12850 (R;US)
Orsini, C.M.Q., *See* Prado, C.P.C. do, 8:12468
Ortale, C., *See* Hull, K., 8:12946
Orvis, D.D., Guidebook for reliability, availability, and maintainability analysis of NWTS repository equipment. Volume II. Appendices, 8:11896 (R;US)
Osborne, J.L., *See* Norman, E.B., 8:13227
Osbourn, G.C., Computer modeling and radiation testing of AlGaAs photodiode structures, 8:13004 (J;US)
Oster, L.A., Peat as a feedstock to the KBW gasification process, 8:11659 (RA;US)
Oster, Z.H., Enhancement of radiopharmaceutical excretion by chemical interventions, 8:13176 (R;US)
Osteryoung, R.A., *See* Chum, H.L., 8:12097
Ostmeyer, R.M., Impact of source term assumptions on reactor accident consequences, 8:12430 (J;US)
Otte, L.J., *See* Ingram, R.L., 8:11697
Ouimette, D., Versatile secondary trigger for a multi-detector system, 8:12993 (R;US)
Ovadia, E., *See* Eisen, Y., 8:12985
Overend, R.P., Peat for energy and chemicals research and development program of NRC, 8:11700 (RA;US)
Owczarski, P.C., *See* Sutter, S.L., 8:13031
Owen, M.L., *See* Talty, R.D., 8:11769
Owre, F.A., *See* Visuri, P.J., 8:12362
Owzarski, P.C., Fuel powder transport through container leaks, 8:11860 (J;US)
Oyama, K., *See* do Amorim, E.S., 8:12361
Ozarow, V., Perspectives on states' transportation energy conservation plans, 8:12603 (RA;US)

P

Packer, W.E., Parametric investigations and other related studies of energy storage type capacitors. Quarterly report, 8:12451 (R;US)
Paffrath, L., *See* Logg, C.A., 8:13564
Paganessi, J.E., Peat dewatering: solvent extraction, 8:11747 (RA;US)
Peat gasification: low-severity hydropyrolysis, 8:11602 (RA;US)
Pagani, C., Conceptual design of the electronic controls for the RF cavity of the Milan Superconducting Cyclotron, 8:12919 (R;IT)
Page, R.A., Characterization and analysis of cavity development during creep of ceramics at elevated temperature. Progress report, 1982, 8:12709 (R;US)
Painter, P.C., *See* Given, P.H., 8:11613
Painter, R.B., Screening of mutagens by inhibition of DNA synthesis, 8:13191 (BA;US)
Paisley, M.A., *See* Feldmann, H.F., 8:12071
Pal, D., Operating and maintenance experience with a 6-kW wind energy conversion system at Naval Station, Treasure Island, California. Technical note Sep 79-Jun 81, 8:12261 (R;US)
Palmer, H.E., 1976 Hanford americium exposure incident: in vivo measurements, 8:13147 (R;US)
Panin, R.B., *See* Mikhajlov, V.M., 8:13369
Panitz, J.K.G., Characterization of a procedure for preparing 6061 aluminum alloy for barrier anodization, 8:12689 (R;US)
Pankratz, L.W., Reconnaissance seismic refraction studies at Calico Hills, Wahmonie, and Yucca Mountain: southwest Nevada Test Site, Nye County, Nevada, 8:13214 (R;US)
Panvini, R.S., Novel results in particle physics, 8:13252 (B;US)
Papale, J., *See* Albert, D.M., 8:13185
Parekh, P.P., Activation of Tl, Pb and Bi by 10-160 MeV neutrons: possible application to the analysis of Bi, 8:12769 (J;CH)
Park, J.K., Nodal analysis for reactor kinetics and stability, 8:12348 (D;US)
Parker, B.G., *See* Baker, G.K., 8:12722
Parker, D.S., *See* Merrill, D.T., 8:12624
Parker, G.B., Handbook for the design, selection, and construction of a rock cover for retired uranium-mill tailings, 8:11902 (R;US)
Parkhurst, W.A., Development of improved separators for alkaline zinc batteries. Final report, 8:12455 (R;US)
Parkinson, B.A., *See* Kam, K.K., 8:12811
Parr, A.C., *See* Rosenstock, H.M., 8:12809
Parry, G.W., *See* Rice, R.C., 8:11720
Paschoa, A.S., Uranium content of petroleum by fission track technique, 8:12761 (R;BR)
Pascoe, D.M., Summary of mineral industry activities in Colorado. Part I: coal, 8:11784 (R;US)
Passman, R.A., Commercialization status - DOE programs, 8:11786 (RA;US)
Pasyuk, A.S., *See* Anan'in, O.B., 8:12922
Patrick, W.C., Experimental and calculational results from the Spent Fuel Test-Climax, 8:11854 (R;US)
Patterson, C.S., Carbonate equilibria in hydrothermal systems: first ionization of carbonic acid in NaCl media to 300°C, 8:12254 (J;GB)
Patty, B.W., *See* Nesbitt, S.A., 8:13055
Patzeltova, N., *See* Ivan, J., 8:13095
Paul, W., *See* Kirby, P.B., 8:12734
Payatakes, A., *See* Wasan, D., 8:11799
Payne, G.L., *See* Perez, J.D., 8:13462
Payne, R., *See* England, G., 8:11961
Payne, R.E., *See* Cohen, S.J., 8:11592
Peach, J.T., *See* Weatherby, J.L. Jr., 8:12467
Peak, J.G., *See* Peak, M.J., 8:13163
Peak, M., *See* Jirka, A., 8:13178
Peak, M.J., Single-strand breaks induced in Bacillus subtilis DNA by ultraviolet light: action spectrum and properties, 8:13163 (J;GB)
Pearl, W.L., *See* Putkey, T.A., 8:12307

Pease, R.I., Electrical overstress failure in silicon solar cells, 8:12086 (R;US)
Pedersen, D.R., *See* Miles, K.J., 8:12360
Pederson, R.J., *See* Rice, R.C., 8:11720
Pefil, J.E., Evaluation of a system utilizing biomass (straw) as fuel for crop drying and heating on the farm, 8:12064 (R;CA)
Peirce, J.J., *See* Vesilind, P.A., 8:12631
Peklenkov, V.D., *See* Anan'in, O.B., 8:12922
Pellegrini, C., High energy e^+-e^- collider using an inverse free electron laser accelerator, 8:12894 (R;US)
See Krinsky, S., 8:12937
See Luccio, A., 8:12864
Pellet, D., *See* Bulos, F., 8:12897
Pellet, R.J., *See* Mahoney, J.A., 8:11617
Pendergrass, J.H., Multipass batch-step advanced isotope separation campaign models, 8:11845 (J;US)
Pendleton, D.F., Research issues in grazing lands under changing climate. Volume 12, Part 16. Environmental and societal consequences of a possible CO_2-induced climate change, 8:13061 (R;US)
Penko, M., *See* Pratt, D.C., 8:12095
Penneman, R.A., Plutonium roundtable discussion, 8:12824 (R;US)
Percival, W., Biomass fueled Stirling engine system research and development, 8:12081 (RA;US)
Perez, J.D., Scattering of a particle beam by a non-equilibrium plasma, 8:13462 (J;GB)
Perez-Blanco, H., Study of heat and mass transfer in a vertical-tube evaporative cooler, 8:12614 (R;US)
Perez-Mendez, V., *See* Geaga, J.V., 8:13313
Perez-Mercader, J., *See* Haymaker, R.W., 8:13287
Perin, A.H., *See* Senise, J.T., 8:12036
Perkins, L.J., Generation of DT and DD neutrons from high-power neutral-beam dumps, 8:13514 (J;US)
Perl, M., *See* Bulos, F., 8:12897
Perlman, M., Performance and reliability of residential solar water heaters, 8:12138 (RA;US)
Perri, E.B., *See* Senise, J.T., 8:12036
Perrin, D.R., *See* Gladney, E.S., 8:13028
Perry, A.M., *See* Livingston, R.S., 8:12490
Perry, D.L., *See* Brittain, H.G., 8:12794
Personett, M.I., *See* Davis, R.J., 8:12183
Pesch, W., Structure and phase transitions in the vanadium-hydrogen and vanadium-deuterium system, 8:11957 (R;DE;In German)
Petek, M., *See* Sales, B.C., 8:11867
Peters, C., Peat resource estimation in Rhode Island, 8:11713 (RA;US)
Petersen, J.D., *See* Pfenning, K.J., 8:12797
Peterson, C.W., Experimental and theoretical investigation of the reduction in parachute drag caused by forebody wake effects: data compilation and program summary, 8:12871 (R;US)
Peterson, J.M., Peat resource assessment for the State of New York, 8:11711 (RA;US)
Peterson, J.R., Physical-chemical studies of transuranium elements. Progress report, April 1, 1982-March 31, 1983, 8:12775 (R;US)
See Coggiola, M.J., 8:13472
Petrakis, L., *See* Gates, B.C., 8:11619
Petrov, N.I., *See* Golovin, B.M., 8:12970
Petschek, A.G., *See* Colgate, S.A., 8:13231
Pettitt, R.A., *See* Carden, R.S., 8:12246
Petty, W.F., *See* Cook, J.H., 8:11948
Peyerbrune, H., Perspectives on states' transportation energy conservation plans, 8:12604 (RA;US)
Pfenning, K.J., Preparation, reactivity, and stability of mixed-metal bimetallic complexes containing the pentacyanoferrate(II) moiety, 8:12797 (J;US)
Phillips, R.D., Biological effects of high-strength electric fields on small laboratory animals. Interim report, March 1, 1978-September 30, 1979, 8:13194 (R;US)
Phillips, S.L., Treatment methods for geothermal brines, 8:12252 (J;US)
Phillips, W.E., *See* Thurber, W.R., 8:12885
Pickrell, M.M., Role of radiation on the power balance of the Alcator C tokamak, 8:13423 (R;US)
Pierce, R.D., Molten carbonate fuel cells: technology status, 8:12534 (BA;US)
Piesch, E., Application of a single sphere albedo technique in stray neutron fields, 8:12986 (RA;US)
Energy dependence of neutron dosemeters for personnel monitoring, 8:12957 (RA;DE;In German)
Improvement of electrochemical etching technique in neutron dosimetry, 8:13382 (RA;DE;In German)
Progress in albedo neutron dosimetry using TLD and track etch detectors, 8:12987 (RA;US)
Results of routine monitoring with albedo-dosemeters, 8:12959 (RA;DE;In German)
State of the art in Albedo-neutron dosimetry, 8:12958 (RA;DE;In German)
See Burgkhardt, B., 8:12952, 8:12955
Pilgrim, B.F., Homeowners survey: gas utilities and the residential solar market, 8:12640 (R;US)
Pillai, S.R., *See* Bhat, N.P., 8:12319
Pimpl, M., Plutonium contamination of the 'Altrhein' river, 8:13088 (R;DE;In German)
Pinder, G.F., Physics of flow in geothermal systems, 8:12250 (J;US)
Pinder, J.E. III, *See* Corey, J.C., 8:13067
Pinheiro, R.B., *See* Lameiras, F.S., 8:12358
Pinho, S.Z., *See* Serra, C.E., 8:12037
Pinto, A.G., *See* Doin, P.A., 8:12038
Pinto, L.C.M., *See* Lameiras, F.S., 8:12358
Pinto, L.R., *See* Paschoa, A.S., 8:12761
Pirtle, F.W., Closed cycle cryocooler for low temperature electronic circuits. Phase II. Preliminary design. Final report 15 May-30 Sep 81, 8:12837 (R;US)
Pischinger, F.F., International outlook of Otto versus diesel cycle engine for operation on biomass fuels, 8:12652 (RA;BR)
Piskarev, I.M., Photon-nucleus interaction at the energies below the photonuclear reaction threshold, 8:13370 (RA;SU;In Russian)
Pitman, S.G., Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments, 8:12687 (R;US)
Pitts, L., *See* Abraham, K.M., 8:12454
Pivovarova, Z.I., *See* Kobysheva, N.V., 8:12011
Pizzini, S., *See* Giarda, L., 8:12060
Pizzini, V., *See* Giarda, L., 8:12060
Plackmeyer, J., Computer simulation of the dynamic behaviour of a coal-fired power plant with pressurized fluidized bed, 8:12267 (R;DE;In German)
Plake, W., *See* Quam, W., 8:12980
Plantier, Andre, Isotopic separation device on-line with a heavy ion accelerator, 8:12926 (R;FR;In French)
Platts, D.A., *See* Barnes, C.W., 8:13438
See Hoida, H.W., 8:13437
Plazy, J.L., Comes action in solar meteorology, 8:12007 (RA;CH)
Plodinec, M.J., Cesium glass irradiation sources, 8:11947 (R;US)
Poe, S.H., *See* Hower, J.C., 8:11669
Pohl, B.A., *See* Hansen, L.F., 8:13378
Pohland, F.G., *See* Cross, W.H., 8:11684
Pollard, W., *See* Burns, R.E., 8:12336
Pomroy, C., *See* Cohen, N., 8:13401
Ponomarev, V.Yu., *See* Nguen Din' Dang, 8:13326
Pope, R.B., *See* Lamoreaux, G.H., 8:11861
Popovich, J.M., *See* Adam, R.F.J., 8:11732
Popper, I.O., *See* Srivastava, K.C., 8:12029
Porat, D., *See* Ouimette, D., 8:12993
Porter, D.L., *See* Foster, J.P., 8:12359
Porter, R.W., Load requirements for economical cogenerated energy facilities in Chicago. Energy Management Memorandum TM-82-8, 8:12638 (R;US)
See Chaudhary, Z.H., 8:12639
Posey, F.A., *See* Bennett, M.R., 8:12808
Poskanzer, A.M., *See* Gutbrod, H.H., 8:13297
Post, D., Alpha-particle simulation and diagnostics using $_3He^{++}$ minority ICRF heating, 8:13450 (R;US)
Post, D.E., *See* Grisham, L.R., 8:13448
Post, W.M., *See* DeAngelis, D.L., 8:13073
Potts, J.D., *See* Schindler, H.D., 8:11618
Poutsma, M.L., Thermolysis of model compounds for coal. 2. Condensation and hydrogen transfer during thermolysis of naphthols, 8:11665 (J;US)
Powell, J.A., *See* Chikalla, T.D., 8:11899
Powell, J.R., *See* Steinberg, M., 8:11849
Powers, H.G., *See* Dutt, D.S., 8:12370
Prado, C.P.C. do, Environmental impacts of energy utilization, 8:12468 (R;BR;In Portuguese)
Prakash, M., *See* Kolomiets, V.M., 8:13365
Pratsch, L., Carpools and vanpools - potential for major energy savings, 8:12597 (RA;US)
Pratt, D.C., Emergent aquatics: stand establishment, management, and species screening, 8:12095 (R;US)
Pratt, D.W., *See* Singham, S.B., 8:12817
Prausnitz, J.M., *See* Dimitrelis, D., 8:12792
Prejzendorf, V.A., *See* Kazacha, V.I., 8:12903
Prend, D.J., *See* Hook, K.A., 8:11855
Prenger, F.C., Conceptual designs for 100-MW space radiators, 8:12322 (R;US)
Preston, C.C., *See* Gold, R., 8:12398

Preston-Anderson, A., *See* Weseman, M., 8:12466
Price, J.D., *See* Wan, E.I., 8:12074
Price, P.B., *See* Ahlen, S.P., 8:12984
Price, R.H., Uniaxial and triaxial compression test series on Calico Hills tuff, 8:13219 (R;US)
Probert, P.B., *See* Dokuzoguz, H.Z., 8:11586
Proscia, J., *See* Gordon, R.G., 8:12094
Pruett, H.D., System for developing HP41CV hand-held calculator programs on an HP9845 desktop computer, 8:13561 (R;US)
Pryor, T., *See* Burns, R.E., 8:12336
Puig, J.E., Fluid microstructures and enhanced oil recovery, 8:11800 (J;US)
Puigh, R.J., *See* Lynch, W.G., 8:13344
Punwani, D.V., *See* Biljetina, R., 8:11605
See Mensinger, M.C., 8:11603
See Paganessi, J.E., 8:11602, 8:11747
See Pyrcioch, E.J., 8:11604
See Wall, B.D., 8:11608
Puri, S., Self consistent loop antenna theory, 8:13436 (R;DE)
Putkey, T.A., Secondary water chemistry control at St. Lucie No. 1, 8:12307 (R;US)
Pyrcioch, E.J., Single-stage fluidized-bed gasification, 8:11604 (RA;US)
Pyryaev, V.P., *See* Akulova, N.V., 8:12827

Q

Quam, W., Pocket neutron rem meter, 8:12980 (RA;US)
Quam, W.M., *See* Brackenbush, L.W., 8:12978
Queener, D.S., *See* Silver, E.G., 8:12429
Queirolo, A., *See* Lamontagne, J., 8:12497
Quick, J.A. Jr., *See* Morris, J.A., 8:12099
Quigg, C., *See* Schonfeld, J.F., 8:13411
Quigley, E.J., *See* Berry, J.R., 8:13146
quinn, D., *See* Leatherman, G.L., 8:12666
Quinones, D.F., *See* McMaster, W.H., 8:12420
Qutubuddin, S., *See* Miller, C.A., 8:11801

R

Rabotnov, N.S., *See* Masterov, V.S., 8:13366
Racki, D.J., *See* Kasner, W.H., 8:12866
Radeka, V., *See* Kraner, H.W., 8:12943
Radkey, R.L., Wind-flow field measurements in the wake of the Barstow Solar-Thermal Power Plant, 8:12126 (R;US)
Radosevich, L.G., 10-MWe central-receiver solar-thermal pilot plant data-evaluation plan, 8:12123 (R;US)
Raeuchle, E., Wave and plasma heating, 8:13425 (RA;DE;In German)
See McCarthy, A.L., 8:13430
Ragan, H.A., 1976 Hanford Americium exposure incident: hematologic effects, 8:13149 (R;US)
Ragheb, M.M.H., Tritium-tritium fusion: blanket neutronics and photonics, 8:13513 (J;US)
Rahbany, E.P., *See* Forney, R.H., 8:11761
Rainey, J.A., *See* Bjornstad, D.J., 8:12065
Rainey, R.H., *See* Burch, W.D., 8:11847
Raione, R.P., *See* Hower, J.C., 8:11669
Rajas-Negrete, C.R., *See* Fitzer, J., 8:12111
Raju, M.R., *See* Tokita, N., 8:13152
Ramalho, A., *See* Menlove, H.O., 8:11939
Ramey, H.J. Jr., Well-loss function and the skin effect: a review, 8:11798 (J;US)
Ramos, J.J., *See* Antonsen, T.M. Jr., 8:13460
Ramspott, L.D., *See* Patrick, W.C., 8:11854
Ramthun, H., *See* Alberts, W.G., 8:12956
Rand, H.J., Measurement and data reduction techniques: solar water preheat systems, Illinois Power Company, 8:12139 (RA;US)
Ranganathan, R., *See* Bhat, N.P., 8:12319
Ranney, J.W., Short-Rotation Woody-Crops Program. Annual progress report for 1981, 8:12066 (R;US)
Rao, C.D., Policy and planning for the development of deep basin lignite on the Gulf Coast, 8:11726 (RA;US)
Raridon, R.J., Validation of the atmospheric transport model: comparison of observed krypton-85 concentrations with those computed using a Gaussian plume model, 8:13048 (J;US)
Rask, N., Biomass: its utilization as food and/or fuel, 8:12027 (RA;BR)
Rasmussen, D.E., Overview of the Monitored Retrievable Storage (MRS) program, 8:11904 (R;US)
Rasmussen, N.H., Impact of seismicity on the stability of an underground repository, 8:11906 (R;US)
Rasmussen, S.E., *See* Joergensen, J.-E., 8:12780
Rastogi, R.C., *See* Seshadri, K.S., 8:12730
Ratis, Yu.L., *See* Kadmenskij, S.G., 8:13333
Rauh, R.D., *See* Langmuir, M.E., 8:12023
Rawlinson, S., Alaska peat resource estimate, 8:11703 (RA;US)
Rawls, J.M., *See* Stacey, W.M. Jr., 8:13480
Raybold, N.A., *See* Treher, E.N., 8:11923
Read, A.L. Jr., Smith, J. G., *See* Ford, W.T., 8:12940
Read, P.E., *See* Pratt, D.C., 8:12095
Reasoner, J.W., *See* Lloyd, W.G., 8:11672
Rebbi, C., Lattice gauge theories, 8:13283 (R;US)
Why QCD lattice theory is important to spin physicists, 8:13285 (R;US)
Recami, E., Confinement and hadron-hadron interactions by general relativistic methods, 8:13277 (R;IT)
See Barut, A., 8:13406
Reda, D.C., *See* Eaton, R.R., 8:11917
Reed, K., ZAPP: Z-pinch atomic physics program, 8:13452 (R;US)
Reed, T.B., Biomass-to-methanol specialists' workshop, 8:11983 (R;US)
Rees, G.H., Inductive-wall and longitudinal space-charge impedances in LAMPF II, 8:12905 (R;US)
Rees, J., Controlling energy consumption in single buildings. Final report for period ending May 82, 8:12551 (R;US)
Regan, J.D., *See* Snyder, R.D., 8:13161, 8:13169
Regge, P. de, *See* Brabant, R. van, 8:12299
Regulla, D.F., Investigations in the field of beta-dosimetry, 8:13385 (RA;DE;In German)
New tasks and techniques in the measurement of high radiation doses, 8:12951 (RA;DE;In German)
State of the art in thermoluminescent dosimetry using dosemeters with automated read-out, 8:12953 (RA;DE;In German)
Rehme, K., Experimental investigations on the fluid flow through an asymmetric rod bundle (W/D = 1.118), 8:12869 (R;DE;In German)
Reid, A.B. Jr., *See* Gehri, D.C., 8:11686
Reid, M.C., *See* Albert, D.M., 8:13185
Reiners, W.A., *See* Lovett, G.M., 8:13020
Reinke, R., Distilling alcohol with waste automobile heat. Final report, 8:12617 (R;US)
Reinstrom, R.M., Carbonate fuel cell power plant systems, 8:12544 (BA;US)
See Schnacke, A.W., 8:12524
Reiter, E.R., Effects of atmospheric variability on energy utilization and conservation, 8:12555 (RA;CH)
Rej, D.J., Zero-dimensional model for field-reversed configurations, 8:13440 (R;US)
Rejman, S.I., *See* Kal'ner, V.D., 8:12672
Rekolo, M.P., Polarization phenomena in the $e^- + {}^6Li \rightarrow e^- + {}^6Li^*$ process, 8:13308 (RA;SU;In Russian)
Remick, R.J., High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982, 8:12057 (R;US)
Remini, W.C., *See* Haff, K.W., 8:11946
Renier, J.P., Dose levels and neutron reaction rates for HPRR and SHEBA, 8:12438 (J;US)
Renner, T., *See* Gutbrod, H.H., 8:13297
Reno, H.W., *See* Schmitt, R.C., 8:11883
Rensfelt, E., *See* Waldheim, L., 8:11989
Renshaw, A.W., Investigation of the effect of the uranyl ion on proton-spin-relaxation times in aqueous solutions, 8:13007 (R;US)
Repshe, Eh.A., *See* Guseva, T.V., 8:13336
Reville, P., *See* Miles, K.J., 8:12360
Rhoads, K., Distribution of inhaled $^{239}PuO_2$ in rat and hamster lung, 8:13165 (J;GB)
Rhoderick, J.E., Petrographic examination of several four-year-old laboratory developed grout mixtures, 8:12740 (R;US)
Rice, G.W., Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R;US)
Rice, M.J. Jr., *See* Sarma, K.R., 8:12098
Rice, R.C., Activities in low-rank coal in the Northern Great Plains, 8:11720 (RA;US)
Rich, B.L., Technical assessment of radiation overexposures at Three Mile Island from the August 28, 1979, entry into the Unit 2 Fuel-Handling Building Makeup Valve Room, 8:12389 (R;US)
Rich, J.P., Technology of wood supply, 8:11992 (RA;US)
Richards, P., *See* Mausner, L.F., 8:12912
Richards, P.M., *See* Brinkmann, D., 8:12698
Richardson, S., *See* Walters, A., 8:11690
Richey, W.M., A description and evaluation of the Jackson County Action to Save Energy Program. Final report, 8:12549 (R;US)

Richmann, D.L., *See* Davis, R.J., 8:12183
Richter, B.E., *See* Jackson, W.P., 8:12750
Rickabaugh, J., *See* Walsh, J., 8:11959
Riedesel, H., *See* Gutbrod, H.H., 8:13297
Rieken, G.A., *See* Palmer, H.E., 8:13147
Rill, R.L., Impact of energy-related pollutants on chromosome structure. Progress report, January 1, 1982-December 31, 1982, 8:13182 (R;US)
Rindeberger, M., *See* Manes, A., 8:12257
Ringberg, H., *See* Aittola, J.-P., 8:11912
Rinkleff, L., Effect of physical characteristics on heat transfer over a gas free-flowing interface, 8:12384 (R;DE;GE)
Ritter, H.G., *See* Gutbrod, H.H., 8:13297
Ritter, M.W., *See* Howell, R.H., 8:12934
Ritzinger, W., *See* Winkler, W., 8:12397
Roach, F., *See* Kirschner, C., 8:12160
Roberto, J.B., Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R;US)
Roberts, J.H., *See* Gold, R., 8:12398
Robertus, R.J., *See* Mudge, L.K., 8:12067
Robinson, B., 1976 Hanford americium exposure incident: organ burden and radiation dose estimates, 8:13148 (R;US)
See Spitz, H.B., 8:13156
Robinson, P.D., *See* Munson, L.F., 8:13049
Robison, W.L., *See* Crase, K.W., 8:13400
rocco, J.C., *See* Clegg, T.B., 8:13235
Rodgers, B.R., *See* Johnson, J.K., 8:11655, 8:11656
Rodgers, J.C., *See* Wenzel, W.J., 8:13065
Rodrigues, D., *See* Prado, C.P.C. do, 8:12468
Roesch, W.C., *See* Braby, L.A., 8:13392
Rogers, D.Z., Examination of alternative catalysts for biomass direct liquefaction, 8:12083 (RA;US)
Rogers, L.A., Analysis of three geopressured geothermal aquifer-natural gas fields; Duson Hollywood and Church Point, Louisiana, 8:12186 (R;US)
See Knutson, C.F., 8:12200
Rogers, M.L., *See* Kershner, C.J., 8:13486
Rogowsky, M.L., NEPA process and direct coal liquefaction constraint or opportunity, 8:11594 (RA;US)
Rohatgi, N.T., *See* Ciliberti, D.F., 8:11627
Rohay, A.C., *See* Rasmussen, N.H., 8:11906
Rohrer, J.W., Peat commercialization projects in Maine and Alaska, 8:11782 (RA;US)
Rollett, H., *See* Thayer, G.R., 8:12063
Roloff, J.N., *See* Iyer, H.M., 8:12204
Romesberg, L.E., *See* May, R.A., 8:12863
Romo, J.G., *See* Dini, J.W., 8:12690
Roney, D.M. Jr., Geothermal development on military lands: US Navy contract regulations from a developer's point of view, 8:12228 (RA;US)
Rood, P.L., *See* Thayer, G.R., 8:12063
Roos, J., *See* Brinkmann, D., 8:12698
Rope, S.K., *See* Wickham, L.E., 8:11882
Rosa, F., *See* Nanni, H., 8:12654
Rosado, M., *See* Sletten, A.M., 8:12668
Rose, G.R., *See* Kosowski, G.M., 8:12072
Rose, P.F., ENDF/B fission-product data, 8:13321 (R;US)
Rosen, L., *See* Gudiksen, P., 8:13196
Rosenfield, A.R., Failure of ceramics from multiaxial stresses. Second progress report, November 2, 1981-October 31, 1982, 8:12705 (R;US)
Rosenstock, H.M., Fragmentation mechanism and energetics of some alkyl halide ions, 8:12809 (J;US)
Rosner, J.L., *See* Schonfeld, J.F., 8:13411
Ross, B., *See* Mercer, J.W., 8:11891
Rossbander, W., *See* Hohmuth, K., 8:12472
Rosse, C., Marrow-tumor interactions: the role of the bone marrow in controlling chemically induced tumors. Annual progress report, August 1, 1981-July 31, 1982, 8:13118 (R;US)
Rossi, R.M., *See* Uberbacher, E.C., 8:13105
Rota, G., Investigations and experiments by SNAM on the interchangeability of gases, 8:11823 (TG;GB)
Roth, G., Transport in rotary drums and ball mills, 8:12849 (R;DE;In German)
Rothman, S.J., Chemical diffusion of Ta in γ-U in samples fabricated for positron studies, 8:12694 (J;NL)
Rousseau, D.L., *See* Shelnutt, J.A., 8:12812
Rousseau, J., Solar/gas Brayton/Rankine cycle heat pump assessment. Final report Apr 81-May 82, 8:12167 (R;US)
Routt, K.R., Theoretical predictions for continuous-slurry feeding of a glass melter, 8:11879 (R;US)
Rovanpera, S., *See* Abbott, S., 8:12896
Rowley, J.C., *See* Carden, R.S., 8:12246
Rowse, L.A., *See* Nesbitt, S.A., 8:13055
Royster, R.L., Evaluating water heating alternatives, 8:12140 (RA;US)
Rozov, V., *See* Nanni, H., 8:12654
Rubcheuya, V.A., Average values and dispersions of fission fragment kinetic energies in terms of "touching fragments" model, 8:13350 (RA;SU;In Russian)
Ruberto, R.G., *See* Cronauer, D.C., 8:11628
Rubin, S.B., *See* Dolya, S.N., 8:13377
Ruddy, F.H., *See* Gold, R., 8:12398
Rueckle, B., *See* Deutsch, R., 8:13484
Rueppel, D.W., *See* Dreicer, M., 8:13092
Ruoff, C.F., Continued development of a peat biogasification process, 8:11607 (RA;US)
Rupich, M.W., *See* Abraham, K.M., 8:12454
Ruppen, J.A., Some effects of microstructure and chemistry on corrosion and hydrogen embrittlement of TiCode-12, 8:12688 (R;US)
Russel, W.B., *See* Niksa, S., 8:11657
Russell, D.C., Attitudes of the Reagan Administration toward geothermal development, 8:12218 (RA;US)
Russell, R.J., Evaluation of coordinate measuring machines, 8:13005 (R;US)
Rylander, H.G., *See* Brennan, M., 8:13470
See Weldon, W.F., 8:13464
Rymer, M.J., *See* Casteel, R.W., 8:12195
See Sims, J.D., 8:12194
See Thompson, J.M., 8:12213
Ryther, J.H., Cultivation of macroscopic marine algae, 8:12096 (R;US)

S

Sabalyauskas, L.Yu., *See* Vanagas, V.V., 8:13363
Sachs, R.G., Theoretical studies of high-energy phenomena: analysis of models of CP and T violation. Progress report, May 1, 1981-April 30, 1983, 8:13274 (R;US)
Sacker, D.F., *See* Oster, Z.H., 8:13176
Sadowski, M., *See* Deutsch, R., 8:13428
Safarov, R.Kh., *See* Brianson, Sh.I., 8:13357
See Muminov, A.I., 8:13339
Safin, M.Ya., *See* Bogdanov, Yu.P., 8:13310, 8:13311
Sage, W.L., *See* Forney, R.H., 8:11761
Sagle, A.L., *See* Geaga, J.V., 8:13313
Saib, S.H., Validation of real-time software for nuclear-plant-safety applications. Final report, 8:12391 (R;US)
Saiki, T., *See* Ljungdahl, L.G., 8:13135
Saka, N., *See* Suh, N.P., 8:12835
Sal'nikova, O.V., *See* Katan, I.B., 8:13549
Sales, B.C., Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance, 8:11867 (R;US)
Sallee, W.W., *See* Brandon, W.E., 8:12991
Salmon, E.J., Comparative assessment of the environmental and health effects associated with selected synthetic and alcohol fuel production/conversion technologies, 8:12032 (RA;BR)
Salzman, G.G., *See* Lott, D.F., 8:12131
Saltelli, A., Assessment of carburization-decarburization behaviour of Fe-9Cr-Mo steels in a sodium environment, 8:12693 (J;NL)
Salvado, V., Voltametric study of indigo red, 8:12773 (TJ;US)
Salvatore, J.E.I., Licensing procedure for construction and operation of nuclear power plants, 8:12324 (R;BR;In Portuguese)
Reactor licensing in the United States and Federal Republic of Germany, 8:12323 (R;BR;In Portuguese)
Salzmann, H., Laser applications, 8:13427 (RA;DE;In German)
Laser applications, 8:13432 (RA;DE;In German)
Samanta, P.K., Incorporation of various uncertainties in dependent failure probability estimation, 8:12433 (J;US)
Samojlova, A.N., *See* Bykov, A.A., 8:13341
Sampath, S.G., *See* Rosenfield, A.R., 8:12705
Samuels, G., Options for electricity use and management during a petroleum shortage, 8:12508 (R;US)
Samuni, A., Cytoxicity of vitamin C and metal ions: a site-specific Fenton mechanism. Progress report, July 1981-June 1982, 8:13180 (R;US)
Sandbakken, S., *See* Brevik, I., 8:12003
Sandberg, R.O., *See* Hook, K.A., 8:11855
Sandenaw, T.A., Causes for the variable superconducting transition temperature in uranium metal, 8:12696 (J;GB)
Sanders, C.L., *See* Rhoads, K., 8:13165
Sanderson, J.E., *See* Levy, P.F., 8:11668

See Ruoff, C.F., 8:11607
Sandoval, J.J., *See* Tancredi, J.J., 8:13489
Sandoval, R.P., Subjecting spent-fuel shipments to extreme environments, 8:11862 (J;US)
Sandreczki, T.C., *See* Brown, I.M., 8:12726
Sanger, H.S. Jr., Selected antitrust issues in utility fuels and equipment purchases, 8:12499 (R;US)
Santee, G.E. Jr., LOCA hydroloads calculations with multidimensional nonlinear fluid/structure interaction. Volume 3. Fluid/structure interaction studies using 3-D STEALTH/ WHAMSE. Final report, 8:12390 (R;US)
Santella, R.M., Z-DNA conformation of N-2-acetylaminofluorene modified poly(dG-dC).poly(dG-dC) determined by reactivity with anti cytidine antibodies and minimized potential energy calculations, 8:13193 (J;GB)
Santoro, R.T., Streaming of 14-MeV neutrons through an iron duct: comparison of measured neutron and gamma-ray energy spectra with results calculated using the Monte Carlo code MCNP, 8:13492 (R;US)
Sanz, F., *See* Salvado, V., 8:12773
Sarma, K.R., Exploratory development of thin-film polycrystalline-silicon photovoltaic devices. Final technical report, 8:12098 (R;US)
Sasao, M., *See* Snover, K.A., 8:13316
Sattelberger, A.P., Metal-metal-bonded complexes of the early transition metals. 4. Synthesis and characterization of the tantalum (II) dimer $Ta_2Cl_6(PMe_3)_4$, 8:12796 (J;US)
Sauer, K., Charge separation in the light reactions of photosynthesis, 8:13128 (BA;US)
Sauerbrunn, A., *See* Deutsch, R., 8:13484
Saunders, M., Preliminary investigations of thermionic converters utilizing HOTEMA and DFVLR electrodes, 8:12519 (R;US)
Sautkulis, R.C., *See* Schairer, L.A., 8:13186
Saville, D.A., *See* Niksa, S., 8:11657
Sawochka, S.G., *See* Putkey, T.A., 8:12307
Saxman, A., *See* Goldstone, P.D., 8:13485
Sazonov, P.B., *See* Krasnopol'skij, V.M., 8:13307
Schaefer, G., *See* Schmitz, V., 8:12877
Schaefler, A.M., *See* Fang, J.M., 8:12565
Schairer, L.A., Monitoring ambient air for mutagenicity using the higher plant Tradescantia, 8:13186 (BA;US)
Schally, P.J., Calculations for LOFT experiment L3-1 with the homogeneous version of the computer code DRUFAN, 8:12396 (R;DE;GE)
Schamaun, J.T., Engineering model for predicting rubble motion during blasting, 8:13220 (R;US)
Schartz, R., *See* Winter, M., 8:13041
Schauer, D.A., PBX-9407 mechanical properties, 8:13012 (R;US)
Scheele, R.D., *See* Burger, L.L., 8:11900
Schefer, R.W., *See* Cattolica, R.J., 8:11958
See Driscoll, J.F., 8:12833
Schell, J.M., Bottom line: can we finance major synfuels construction in the '80's, 8:11774 (RA;US)
Schempp, S., *See* Mueller, J., 8:12898
Schenker, E., *See* Hanulik, J., 8:12382
Schettler, P.D. Jr., Study of hydrocarbon: shale interaction. Progress report 315, July 1-September 30, 1979, 8:11824 (R;US)
Schieler, L., *See* McCurdy, G., 8:11969
Schierholz, G., SU(3) lattice Monte Carlo calculation of the glueball mass spectrum, 8:13269 (R;DE)
Schiffman, Y.M., Technology assessment of solar energy systems. Scenario development and methodology. Volume II, 8:12019 (R;US)
Technology assessment of solar-energy systems. Materials resource and hazardous materials impacts of solar deployment, 8:12021 (R;US)
Schindler, H.D., Integrated two-stage liquefaction. Topical technical progress report completion of Indiana V program, April 1, 1981-September 30, 1981, 8:11618 (R;US)
Schlenker, R.A., Retention of ^{226}Ra in human soft tissue and bone; implications for the ICRP 20 alkaline earth model, 8:13166 (J;GB)
Schlesinger, T., *See* Eisen, Y., 8:12985
Schlinger, W.G., Commercializatin of the Texaco coal gasification process, 8:11588 (RA;US)
Schmidt, A., *See* Hohmuth, K., 8:12472
Schmidt, J.A., *See* Stacey, W.M. Jr., 8:13480
Schmieder, R.W., Agglomeration of polyacetylenic particulates and its relation to soot formation, 8:12821 (RA;US)
Schmitt, J.G., *See* Youngberg, A.D., 8:11623
Schmitt, R.C., Research and disposition of highly loaded organic resins, 8:11883 (R;US)
Schmittroth, F.A., *See* Gold, R., 8:12398
Schmitz, V., Study of flow magnitude by means of ultrasonic holography, 8:12877 (R;DE;GE)
Schmor, P.W., *See* Clegg, T.B., 8:13235
Schnabel, G., Determination of local heat transfer during falling-film evaporation and condensation on fluted surfaces for the purpose of designing high-efficiency evaporators, 8:12875 (TG;US)
Schnacke, A.W., Carbonate fuel cell system development for industrial cogeneration. Final report Mar 80-Aug 81, 8:12524 (R;US)
Schnapp, M.R., *See* Nelson, R.A., 8:11897
Schneider, F., Dynamical properties of charge-dividing proportional counters, 8:12945 (R;XC)
Schneider, H., *See* Abbott, S., 8:12896
Schneider, J.G., Formation of helium-gas bubbles in the vanadium-titanium binary and ternary alloys irradiated by energetic Ni^{++} ions, 8:12674 (R;US)
Schnepple, W., *See* Beyerle, A., 8:12731
See Hull, K., 8:12946
Schobert, H.H., *See* Benson, S.A., 8:11676
Schonfeld, J.F., Convergence of reflectionless approximations to confining potentials, 8:13411 (J;US)
Schraube, H., Results of an international comparitive evaluation of neutron dosemeters for personnel monitoring, 8:13383 (RA;DE;In German)
Schreiber, J.D., *See* Remick, R.J., 8:12057
Schroeder, R.C., Instrumentation for well tests, 8:12251 (J;US)
Schroeder, V., *See* Behrend, H.J., 8:13255
Schroeder Pedersen, A., *See* Lebech, B., 8:12779
Schubert, W.K., Electron-energy-loss and ultraviolet-photoemission study of VN/sub x/, NbN/sub x/, and ZrN/ sub x/, 8:12711 (R;US)
Schuchman, J.C., Final design and status of the NSLS vacuum system, 8:12938 (R;US)
Schueller, P.G., *See* McCarthy, A.L., 8:13430
See Raeuchle, E., 8:13425
Schuettelkopf, H., *See* Pimpl, M., 8:13088
Schuit, G.C.A., *See* Gates, B.C., 8:11619
Schuller, I.K., Superconductivity and magnetism in metallic superlattices, 8:12700 (J;CH)
Schulze, G., *See* Salzmann, H., 8:13427
Schuster, H., Planning of a C-band-pulse-Doppler-radar with polarization diversity for atmospheric research in the meso-scale range, 8:13021 (R;DE;In German)
Schuster, H.J., *See* Alberts, W.G., 8:12956
Schwager, I., Development of new catalysts for coal liquids refining. Final report, January 1979-April 1981, 8:11615 (R;US)
Schwallie, A.L., *See* Dutt, D.S., 8:12370
Schwartz, M.M., *See* Mahoney, J.A., 8:11629, 8:11630, 8:11631
Schwartz, R.B., Use of a D_2O moderated Cf-252 source for dosimeter testing and calibrating, 8:13396 (RA;US)
See Eisenhauer, C.M., 8:13398
Schwartzman, R.G., Thermoluminescence of the mineral components in granite, 8:13216 (R;US)
Schwegler, E.C., *See* Maudlin, P.J., 8:12435
Schweickert, E., *See* Brinkmann, D., 8:12698
Schwendiman, L.C., *See* Owzarski, P.C., 8:11860
Scott, J.E., *See* Sharman, R.B., 8:11587
Scott, R.M., *See* Dyer, F.F., 8:12766
Scriven, L.E., *See* Puig, J.E., 8:11800
Sealock, L.J. Jr., *See* Mudge, L.K., 8:12067
Sears, D.R., *See* Dahlin, R.S., 8:12281
Seaverson, L.M., Synthesis and characterization of oxide interstitial derivatives of zirconium monochloride and monobromide, 8:12791 (R;US)
Sebek, J., Effect of neutron irradiation on the critical temperature of Nb_3Ge, 8:12735 (RA;CS;In Czech)
Seckel, D., Oscillating neutrons and disappearing baryons: a theoretical overview, 8:13275 (R;US)
Segal, L., *See* Manes, A., 8:12257
Sehmel, G.A., Characteristics of airborne plutonium resuspended from near-background aged surface-sources, 8:13047 (R;US)
Seiden, A., *See* Bulos, F., 8:12897
Seidl, F., *See* Post, D., 8:13450
Selamoglu, S., *See* Merte, H. Jr., 8:12305
Selman, J.R., Fuel cells: fundamentals and types - unique features, 8:12532 (BA;US)
Seltzer, N., *See* Chewning, J.S., 8:12369
Selvin, S., Selected epidemiological observations of cell-specific leukemia

mortality in the USA, 1969-1977, 8:13138 (R;US)
Semelr, B.L., Membrane-associated precursor to poliovirus VPg identified by immunoprecipitation with antibodies directed against a synthetic heptapeptide, 8:13108 (J;US)
Semura, J.S., *See* Sinha, D.N., 8:13249
Sen, A.K., *See* Navratil, G.A., 8:13459
Senise, J.T., Microwaves and the industrial production of ethanol, 8:12036 (RA;BR)
Sephton, H.H., Waste-heat vertical tube foam evaporation for cooling tower blowdown renovation/recycle. Project summary report, 8:12277 (R;US)
Sergeenkov, Yu.V., Matrix elements of penetration of the K forbidden ($\Delta K=3$) E1-transitions, 8:13342 (RA;SU;In Russian)
Serra, C.E., Microbiological control of ethanol fermentation in industrial scale, 8:12037 (RA;BR)
Serra, G.E., *See* Moreira, J.R., 8:12031
Seshadri, K.S., Determination of surface area of glass grains by adsorption of methylene blue and its application in the testing of relative impact strength of glasses, 8:12730 (R;IN)
Sethi, V.K., *See* Bates, J.K., 8:12762
Sethna, B.N., Consumer acceptance of electric vehicles, 8:12650 (R;US)
SethuRaman, S., MONEX79 atmospheric boundary-layer experiment over the Bay of Bengal: Digha data report, 8:13019 (R;US)
Setlow, R.B., DNA damage and carcinogenesis, 8:13172 (BA;US)
DNA repair, aging, and cancer, 8:13174 (J;US)
See Hill, H.Z., 8:13162
Shackson, R.H., Maintaining automotive mobility: using fuel economy and synthetic fuels to compete with OPEC oil. Final report, 8:12612 (R;US)
Shade, J.W., Release kinetics and alteration of waste glass in crystalline rock systems, 8:11915 (J;NL)
Shaffer, D.S., *See* Cook, J.H., 8:11948
Shah, D.O., *See* Noronha, J.C., 8:11802
Shahrokh, Z., *See* Hunter, J.A., 8:13109
Shaing, K.C., Neoclassical ripple transport in tokamaks, 8:13507 (J;AT)
Sham, T.L., Effects of triaxial stressing on creep cavitation of grain boundaries, 8:13402 (R;US)
Shamai, Y., *See* Eisen, Y., 8:12985
Shannon, T.E., *See* Stacey, W.M. Jr., 8:13480
Shannon, W.E., *See* Lyons, J.A., 8:13210
Shapiro, A., *See* Pinder, G.F., 8:12250
Shapiro, M.A., Ohio River Basin energy study: health aspects, 8:12284 (R;US)
Sharma, M.M., *See* Jang, L.K., 8:12772
Sharman, R.B., British Gas slagging gasifier - a springboard into synfuels, 8:11587 (RA;US)
Sharon, A., Destabilization of Leidenfrost boiling by a sudden rise of ambient pressure, 8:12345 (J;GB)
Sharp, D.J., *See* Panitz, J.K.G., 8:12689
Sharp, J.T., *See* Kaplan, E., 8:13133
Shatynski, S.R., *See* Leatherman, G.L., 8:12666
See MacCrone, R.K., 8:12665
Shaw, D.T., *See* Weller, S.W., 8:11679
Sheldon, R.B., *See* Suss, H., 8:12683
Shelgrove, J.L., *See* Deen, J.R., 8:12374
Shelnutt, J.A., Protein influences on porphyrin structure in cytochrome c: evidence from Raman difference spectroscopy, 8:12812 (J;US)
Shen, E.J., Remote-handling demonstration tests for the Fusion Materials Irradiation Test (FMIT) Facility, 8:13482 (R;US)
Sherard, T.D., Intercity freight movement and energy issues, 8:12587 (RA;US)
Sherret, A., *See* Ellis, R.H., 8:12599
Sherwood, A.R., *See* Barnes, C.W., 8:13438
See Hoida, H.W., 8:13437
Shetty, D.K., *See* Rosenfield, A.R., 8:12705
Shinn, W.A., *See* Rothman, S.J., 8:12694
Shipman, L.L., *See* Yuen, M.J., 8:13110
Shipper, K.E., Demonstration ice storage with waste-heat-recovery project. Final report, 8:12570 (R;US)
Shiryaev, B.M., *See* Blinov, M.V., 8:13352
Shishlyannikov, P.T., *See* Alenitskij, Yu.G., 8:12902
Shiue, C.Y., *See* Lambrecht, R.M., 8:13129
Shkarofsky, I.P., Heat transport with cold and hot electrons allowing for flux limitation by Shvarts' method, 8:13467 (R;CA)
Shobbert, Kh., *See* Gersh, Kh.U., 8:13309
Shpinel', V.S., *See* Kal'ner, V.D., 8:12672
Shponka, S., *See* Kaplan, E., 8:13133
Shriner, D.S., *See* Olson, R.J., 8:13062
Shtaras, S.S., *See* Vainoris, Z.A., 8:12889, 8:12890
Shugart, H.H. Jr., A computer model of succession and fire response of the high-altitude Eucalyptus forest of the Brindabella Range, Australian Capital Territory, 8:13057 (J;GB)
Long-term dynamics of forest ecosystems, 8:13056 (J;US)
Shukla, B.S., *See* Seshadri, K.S., 8:12730
Sidorov, A.I., *See* Kazacha, V.I., 8:12903
Sidwell, J.V., *See* Smith, S.S., 8:11795
Siegel, M.D., *See* Chu, M.S., 8:11910
Sievers, A.J., *See* Ahrenkiel, R.K., 8:12744
Sikov, M.R., *See* Kelman, B.J., 8:13167
Silva, R., *See* Edelstein, N., 8:12825
Silva Estrada, J.J. da, *See* Knoefell, T.M.J., 8:12944
Silver, E.G., Operating US power reactors, 8:12297 (J;US)
Reports, standards, and safety guides, 8:12429 (J;US)
Status of power-reactor projects undergoing licensing review, 8:12332 (J;US)
Simmons, G.W., *See* Klier, K., 8:11970
Sims, C.S., Health Physics Research Reactor operating history and recent improvements, 8:12379 (J;US)
Sims, J.D., Late Pleistocene stratigraphy and palynology of Clear Lake, 8:12194 (RA;US)
Mercury in the sediments of Clear Lake, 8:12214 (RA;US)
See Thompson, J.M., 8:12213
Sindt, H., *See* Behrend, H.J., 8:13255
Sineath, H.H., *See* Flanigan, V.J., 8:12073
Singer, M.I., *See* Passman, R.A., 8:11786
Singer, S., *See* Goldstone, P.D., 8:13485
Singethan, J., *See* Wilhelm, R., 8:13426
Singham, S.B., Triplet excitons in 4,4'-dichlorobenzophenone, 8:12817 (J;US)
Sinha, D.N., Superheating limits of liquid helium I, 8:13249 (J;GB)
Sishtla, C.I., *See* Paganessi, J.E., 8:11747
Sivasubramanian, R., *See* Ying, D.H.S., 8:11616
Skaggs, R.L., *See* Onishi, Y., 8:13090
Skenandore, L.H., Arming and firing system for PRE-DIRECT COURSE, 8:13011 (R;US)
Sklar, S., Analysis of five on-farm ethanol units in the United States, 8:12033 (RA;BR)
Skriver, A., *See* Staun Olsen, J., 8:12778
Slate, S.C., Full-scale impact tests of simulated high-level waste canisters, 8:12859 (J;US)
Slater, D.C., Recent laser fusion experiments at KMS, 8:11944 (R;US)
Slattery, J.C., *See* Giordano, R.M., 8:11803
Sletten, A.M., Materials research for hydrogen-cooled superconducting power-transmission lines (SPTL). Part I. Liquid hydrogen as a dielectric. Part II. Superconducting materials. Annual report, January 1, 1981-December 31, 1981, 8:12668 (R;US)
Sliv, L.A., *See* Badalov, S.A., 8:13346
Slocum, G.H., *See* Patterson, C.S., 8:12254
Slonski, M., *See* Levine, N., 8:12179
Slough, J., *See* Navratil, G.A., 8:13459
Slovak, M., *See* Ivan, J., 8:13095
Smedskjaer, L.C., *See* Rothman, S.J., 8:12694
Smeltzer, E.E., *See* Ciliberti, D.F., 8:11627
Smirnov, Yu.F., Spectroscopic factors of α-decay of giant isoscalar resonances, 8:13305 (RA;SU;In Russian)
Smith, A., *See* Budtz-Jorgensen, C., 8:13320
Smith, A.B., Fast-neutron total and scattering cross sections of ^{103}Rh, 8:13319 (R;US)
Smith, C.F., *See* Cohn, J.J., 8:11873
Smith, D.L., *See* Misra, B., 8:13516
Smith, G.A., Engelhard fuel cell programs, 8:12545 (BA;US)
Smith, J., *See* Ragheb, M.M.H., 8:13513
Smith, J.H., *See* Huning, J.R., 8:12012
Smith, L.B., Geothermal Energy Technology: a current-awareness bulletin, 8:12182 (R;US)
Smith, M.L., Bendix CAD-CAM site plan, 8:13538 (R;US)
Smith, P.K., *See* Bibler, N.E., 8:11878
Smith, R.E., Applications of ion chromatography, 8:12747 (R;US)
Smith, R.L., Impact of RCRA (PL 94-580) on the use or disposal of solid wastes from Texas lignite-fired utility boilers: a literature survey. Final report, 8:11687 (R;US)
See Vook, R.W., 8:12695
Smith, R.N., Truck accident and fatality rates calculated from California highway accident statistics for 1980 and 1981, 8:11853 (R;US)
Smith, S.S., North Tisdale Mine: gravity drainage project, 8:11795 (RA;US)
Smith, T.A., Survey of defects in pressure vessels in the UK for the period 1962-1978 and its relevance to nuclear primary circuits, 8:12354 (R;GB)
Smolik, G.R., Effects of coal-gasification atmospheres on pressurized tubes, 8:11647 (R;US)
Smooke, M.D., *See* Miller, J.A., 8:11965
Smugeresky, J.E., *See* Gourdin, W.H., 8:12691

Smyth, J.R., *See* Wohletz, K.H., 8:13218
Snead, C.L. Jr, *See* Bussiere, J.F., 8:12659
Snelgrove, J.L., *See* Bretscher, M.M., 8:12375
Snover, K.A., $^{27}Al(p,\gamma)^{28}Si$ and $^{27}Al(^3He,d)^{28}Si$ to the stretched 11.58-MeV (6^-,0) and 14.36-MeV (6^-,1) levels, 8:13316 (R;US)
See Hoyle, C.D., 8:13315
Snyder, P.H., Development and demonstration of an electric heat pump for waste-heat recovery in industry. The selection of working-fluid candidates for use in high-temperature industrial heat pumps. Topical report, September 1977-December 1978, 8:12620 (R;US)
Snyder, R.D., Differential responses of log and stationary phase human fibroblasts to inhibition of DNA repair by aphidicolin, 8:13161 (J;NL)
Differential responses of log and stationary phase human fibroblasts to inhibition of DNA repair by aphidicolin, 8:13169 (J;NL)
Solames, A.A., *See* Akulova, N.V., 8:12827
Soldat, J.K., *See* Kennedy, W.E. Jr., 8:11901
Soldatov, A.A., *See* Grechukhin, D.P., 8:13354
Solman, F.J., Power processing subsystems for the 100-kWp solar-photovoltaic-power system at the Natural Bridges National Monument in Utah, 8:12110 (R;US)
Solomon, D.E., 1981 inertial fusion research annual technical report, 8:13471 (R;US)
Solomon, P.R., Investigation of vaporization and devolatilization of coal/water mixtures. Second quarterly report, July 20, 1982-October 19, 1982, 8:11642 (R;US)
Solov'ev, V.G., Taking into account the Pauli principle in description of odd deformed nuclei states, 8:13356 (RA;SU;In Russian)
Soltys, M.N., *See* Milne, T.A., 8:12076
Som, P., *See* Oster, Z.H., 8:13176
Somasundaran, P., *See* Celik, M.S., 8:12801
Sombret, C., French status of high level radioactive wastes solidification, 8:11864 (R;FR)
Someahsarali, K., *See* Sephton, H.H., 8:12277
Somerton, W.H., Porous rock-fluid systems at elevated temperatures and pressures, 8:12255 (J;US)
Sommer, H.A., *See* Fong, A., 8:12997
Son, J.R., *See* Flumerfelt, R.W., 8:11806
Sonreal, E.A., *See* Kube, W.R., 8:11718
Soo, P., *See* Ahn, T.M., 8:12686
Sooky, A.A., *See* Shapiro, M.A., 8:12284
Sopori, B., *See* Sarma, K.R., 8:12098
Soran, P.D., *See* Santoro, R.T., 8:13492
Southworth, G.R., Evaporation of phenols from synthetic liquid fuel spills, 8:13082 (J;GB)
Spackman, W., *See* Given, P.H., 8:11613
Spampinato, P.T., Three equipment concepts for the Fusion Engineering Device, 8:13465 (R;US)
Spanoudis, L., Evaluation of solar selective coating stability. Final report, September 1, 1978-May 31, 1980, 8:12178 (R;US)
Sparrow, E.M., Fundamental heat-transfer processes related to phase-change thermal-storage media, 8:12452 (R;US)
Specks, R., Coal liquefaction activities in West Germany, 8:11593 (RA;US)
Spencer, D.W., Models of the distribution of ^{210}Pb in a section across the North Equatorial Atlantic Ocean, 8:13093 (J;US)
Spencer, R.L., Adiabatic compression of elongated field-reversed configurations, 8:13442 (R;US)
Spielman, R.B., Non-recursive lowpass digital-filter algorithm, 8:13560 (R;US)
Spinks, H., *See* Geaga, J.V., 8:13313
Spitz, H.B., Measurements to determine the solubility of uranium yellowcake materials in the lungs of millworkers following acute exposure, 8:13156 (R;US)
Spogen, L.R. Jr., *See* Latorre, V.R., 8:12526, 8:12527, 8:12528, 8:12529, 8:12530
Spoz-Dragan, H., *See* Gadkowski, M., 8:12279
Srivastava, K.C., Preliminary studies on utilization of soybean milling residue for the production of alcohol, 8:12029 (RA;BR)
Srivastava, P.C., *See* Knapp, F.F. Jr., 8:13131
Srivastava, V.C., Design concept for the FED poloidal field coils using an internally cooled cable superconductor, 8:13491 (R;US)
Stacey, W.M. Jr., FED-INTOR activity, 8:13480 (R;US)
Stacken, M., Solar assist water heating, 8:12141 (RA;US)
Stahl, D., Status of development of high-uranium density reduced-enrichment plate-type fuels, 8:12372 (J;US)
Stahl, J., *See* Jordan, J., 8:11670
Stamper, J.A., Studies of laser-plasma interactions, emphasizing ablative acceleration of thin foils, 8:13524 (BA;US)
Stanchi, L., Basic statistics for nuclear electronics, 8:12949 (R;XE;In Italian)
Staph, H.E., Cottonseed oil as a diesel-engine fuel. Final report, 8:12656 (R;US)
Cottonseed oil as a diesel-engine fuel. Part 2. Appendices. Final report, 8:12657 (R;US)
Staples, J., *See* Abbott, S., 8:12896
Stapp, H.P., Topological expansion for baryons and mesons, 8:13281 (J;IT)
Starcher, K., *See* Nelson, V., 8:12266
Starosotnikov, M.I., *See* Kolesnikov, N.N., 8:13368
Startsev, V.I., *See* Gol'dshtejn, V.A., 8:13300
Staudt, J.J., *See* Staph, H.E., 8:12656, 8:12657
Staun Olsen, J., Structural transformation of YbH_3 induced by high pressure, 8:12778 (RA;DK)
Stavnes, S.A., *See* Steeples, D.W., 8:12215
Steenstrup, S., *See* Lebech, B., 8:12779
See Staun Olsen, J., 8:12778
Steeples, D.W., Assessment of the geothermal resources of Kansas. Volume II. Appendices. Final report, 8:12215 (R;US)
Stefanski, M.J., Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA;US)
Stelmo, J., *See* Sebek, J., 8:12735
Stein, R., *See* Vieth, D.L., 8:11856
Steinberg, M., APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 8:11849 (J;US)
Flash pyrolysis of biomass with reactive and non-reactive gases, 8:12078 (RA;US)
Steinberner, U., Experimental study of heat transfer in 1- and 2-layered fluid systems perfused by gas and containing internal heat sources, 8:12385 (R;DE;GE)
Steindler, M.J., *See* Bates, J.K., 8:12762
Steshenko, A.I., *See* Okhrimenko, I.P., 8:13318
Stevenson, J.D., Selected review of foreign safety research for nuclear power plants, 8:12417 (R;US)
Stevenson, W., *See* Baker, J.G., 8:11738
Stevenson, W.A., Large wood to methanol plants, 8:11987 (RA;US)
Stewart, C.R., Proline metabolism in plants under environmental stresses. Progress report, April 1, 1982-December 31, 1982, 8:13126 (R;US)
Stickney, M.C., *See* Bufe, C.G., 8:12193
Stierman, R.J., Magnetic susceptibility of scandium-hydrogen and lutetium-hydrogen solid-solution alloys from 2 to 300°K, 8:12681 (R;US)
Stiles, A.B., *See* Gates, B.C., 8:11612, 8:11619
Stockbauer, R.L., *See* Rosenstock, H.M., 8:12809
Stojanik, B., Pt. 1: Dissolution of plutonium oxide during the process, 8:11884 (RA;XE;In German)
Stokely, J.R., *See* Bate, L.C., 8:12771
Stolzenberg, J., *See* Glustrom, L., 8:13029
Stout, R.P., Nonphotochemical hole burning and the nature of amorphous solids, 8:12737 (R;US)
Strachan, J.D., Density rise experiment on PLT, 8:13501 (J;AT)
See Barnes, C.W., 8:13509
Stradley, N.H., Fireproof ceramics and process for their manufacture, 8:12717 (TG;US)
Strand, R.H., *See* Yeh, G.T., 8:11926
Straszheim, W.E., Direct determination of organic sulfur in coal by electron-beam microanalysis, 8:11677 (R;US)
Strathmann, R.R., *See* Jackson, G.A., 8:13076
Strebin, R.S. Jr., *See* Brauer, F.P., 8:12770
Strip, D.R., Analysis of a proposed one thousand dollar per man-rem cost-effectiveness criterion, 8:12416 (R;US)
Strough, R.I., Preliminary design of an alternate high-temperature turbine. A topical report for Phase II of the High-Temperature-Turbine Technology Program, 8:12276 (R;US)
Stsiborskij, B.D., *See* Blinov, M.V., 8:13352
Stubblefield, F.W., Automated flow microfluorometer and cell sorter incorporating nuclear electronics, 8:13117 (R;US)
Experiment control and data-acquisition system for the biology small-angle x-ray-scattering station, 8:12939 (R;US)
General-purpose stepping motor-encoder positioning subsystem with

standard asynchronous serial-line interface, 8:12911 (R;US)
Stuckwisch, S.E., *See* Chu, M.S., 8:11910
Stuve, J.M., *See* Bennington, K.O., 8:13215
Stygar, W., Particle beams generated by a 6-12.5 kJ dense plasma focus, 8:13502 (J;AT)
Su, T.M., Suppression-pool temperature limits for BWR containments, 8:12406 (R;US)
Subramaniam, T.K., *See* Boegner, F., 8:11590
Suenaga, M., *See* Bussiere, J.F., 8:12659
Suh, N.P., Fundamentals of tribology, 8:12835 (B;US)
Sullenger, D.B., *See* Bowan, R.C. Jr., 8:12719
Sullivan, J.A., *See* Prenger, F.C., 8:12322
Sullivan, R.A., *See* Hickok, W.W., 8:11756
Sullivan, T., *See* Gudiksen, P., 8:13196
Sullivan, W.H., Accident Sequence Evaluation Program, 8:12388 (R;US)
Sultanov, N.V., Multigroup program for calculating the thermal neutron utilization factor in multizone cylindrical reactor cell (MGPRAKTINETs), 8:12340 (R;SU;In Russian)
Summers, R.M., UW-4F: a mechanistic four-fluid two-phase flow model for LOCA analysis during reflood, 8:12442 (D;US)
Sumpter, K.C., *See* Schmitt, R.C., 8:11883
Sun, C.R., Angular distributions of channeled pions and protons up to 250 GeV/c, 8:13243 (J;NL)
Sunder Rajan, N.S., *See* Seshadri, K.S., 8:12730
Sunderman, F.W. Jr., *See* Albert, D.M., 8:13185
See Kuehn, K., 8:13190
Suss, H., Corrosion rates and evaluations of structural materials on the North Atlantic Continental Rise, 8:12683 (R;US)
Sutherland, S.H., *See* Lamoreaux, G.H., 8:11861
Sutliff, L., Peat resource definition and utilization in Massachusetts, 8:11707 (RA;US)
Sutter, S.L., Accident-generated aerosols: assessment methodology, 8:13031 (R;US)
See Owzarski, P.C., 8:11860
Suvorov, M.M., *See* Akulova, N.V., 8:12827
Suydam, B.R., Can optical phase conjugators produce a very short conjugate pulse, 8:12867 (BA;US)
Swain, D.W., Efficient technique for magnetic analysis of non-circular, high-beta tokamak equilibria, 8:13505 (J;AT)
Swanson, H.E., *See* Hoyle, C.D., 8:13315
Sweeney, D., *See* Lindsey, G., 8:11994
Swenson, C.E., *See* Kasner, W.H., 8:12866
Swiatecki, W.J., *See* Blocki, J., 8:13335

T

Tabacniks, M.H., *See* Prado, C.P.C. do, 8:12468
Tachiiuski, W., *See* Winter, M., 8:13041
Tadlock, W.E., *See* Bowan, R.C. Jr., 8:12719
Taesler, R., Climate, energy demands and energy consumption with special regard to human settlements, 8:12553 (RA;CH)
Tahami, J.E., *See* Gordon, J.J., 8:12020
See Schiffman, Y.M., 8:12021
Talley, D., *See* Bowen, B.M., 8:13043
See Van Etten, D., 8:13042
Talty, R.D., Fluidized-bed combustion studies of Texas lignite, 8:11769 (RA;US)
Tamberg, Yu.Ya., *See* Guseva, T.V., 8:13336
Tamhankar, S.S., Studies on the regeneration of sulfided iron oxide sorbent with steam-air mixtures. Final technical report, 8:11626 (R;US)
See Alexander, J.H., 8:11660
Tamiya, K., Mirror finishing of metals using the electrolytic-abrasive mirror-finishing method, 8:12702 (TJ;US)
Tammelin, B., Solar and wind energy research in connexion to community and building planning, 8:12010 (RA;CH)
Tanaka, K., Neutrino mixing in grand unified models, 8:13271 (R;US)
Tanaka, S., *See* Kitagaki, T., 8:13257
Tancredi, J.J., Development program for a 200-kW, c-w gyrotron. Quarterly report No. 10, October-December 1981, 8:13489 (R;US)
Tang, W.M., Influence of diamagnetic drifts on critical beta in tokamaks, 8:13508 (J;AT)
Tannenbaum, M.J., Standard model group, QCD subgroup - dynamics isolating and testing the elementary QCD subprocess, 8:13284 (R;US)
Tanner, R.L., *See* Grisham, D.L., 8:12443
Tanzer, F., *See* Eppel, D., 8:13415
Tarasov, V.K., *See* Bykov, A.A., 8:13329
Tarbell, W.W., Hydrogen production during fragmented debris/concrete interactions, 8:12419 (R;US)
Tarle, G., *See* Budiansky, M.P., 8:12995
Tartankovskij, V.K., *See* Malyarzh, E.I., 8:13301
Tavares, O.A.P., *See* Knoëfell, T.M.J., 8:12944
Tawarah, K.M., Kinetics and mechanism of methanol decomposition over zinc oxide, 8:11982 (R;US)
Taylor, D.S., T-3 cask handling systems at HFEF, 8:12446 (J;US)
Taylor, F.E., *See* Abe, K., 8:13253
Taylor, J.M., RADTRAN II: revised computer code to analyze transportation of radioactive material, 8:11852 (R;US)
Taylor, L.T., Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, July 1, 1982-September 30, 1982, 8:11632 (R;US)
Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, October 1-December 31, 1982, 8:11673 (R;US)
Taylor, R.W., *See* Miles, J.S., 8:12136
Taylor, T., *See* McKelvey, T., 8:13476
Teachman, J.D., Nonlinear diffusion theory model for xenon-induced flux oscillations, 8:12346 (D;US)
Teig, L.J., Charged-hyperon production by 400-GeV/c protons, 8:13260 (R;US)
Telegin, Yu.N., *See* Derkach, A.Ya., 8:12924
Tempel, N.R., *See* Schairer, L.A., 8:13186
Templeton, T., *See* Berndt, C.C., 8:12708
Tench, D., *See* Nouffi, R., 8:12093
Tepel, R.C., *See* Bjornstad, D.J., 8:12065
Teper, M., *See* Schierholz, G., 8:13269
Teplyakov, V.A., *See* Glazov, A.A., 8:12895
Tereshin, Yu.V., *See* Filippov, G.F., 8:13362
Terra, J.L., *See* Lameiras, F.S., 8:12358
Terry, R.L., Economics of coal preparation, 8:11743 (RA;US)
Terwilliger, K.M., *See* Lee, Y.Y., 8:12899
Teske, C.E., *See* Hill, L.E., 8:12017
Tessendorf, J., *See* Fried, H.M., 8:13247
Tetzlaff, G., Wind measurements for large wind turbines, 8:12258 (RA;CH)
Tewari, S.K., Technological aspects of wind energy conversion, 8:12262 (RA;CH)
Thacker, H.B., Integrability, duality, monodromy, and the structure of Bethe's ansatz, 8:13405 (R;US)
See Schonfeld, J.F., 8:13411
Thayer, G.R., Levelized life-cycle costs for four residue-collection systems and four gas-production systems, 8:12063 (R;US)
Theis, J.D., *See* Hornig, A.W., 8:12091
Theiss, J.C., *See* Nguyen, T.V., 8:13130
Thie, J.A., Third Specialists Meeting on Reactor Noise, 8:12344 (J;US)
Thilly, W.G., Health effects of combustion-generated soot and polycyclic aromatic hydrocarbons: human cell studies. Progress report, 1977-1983, 8:13181 (R;US)
Thomas, F.A., *See* Stevenson, J.D., 8:12417
Thomas, G.H., *See* Cleaver, J.E., 8:13132
Thomas, M.T., *See* Jones, R.H., 8:12760
Thomas, S.D., *See* Mercer, J.W., 8:11891
Thomas, V.W., *See* Young, J.A., 8:13044
Thomas, V.W. Jr., *See* Kalkwarf, D.R., 8:13151
Thomassen, B.B., *See* Visuri, P.J., 8:12362
Thome, R.J., *See* Stacey, W.M. Jr., 8:13480
Thomlinson, W., Research using synchrotron radiation at the National Synchrotron Light Source, 8:12910 (R;US)
Thompson, A.C., X-ray powder diffraction system for chemical specification of particulate aerosol samples, 8:12764 (J;NL)
Thompson, D.O., *See* Thompson, R.B., 8:12880
Thompson, J.M., Chemical analyses of waters from springs and wells in the Clear Lake volcanic area, 8:12209 (RA;US)
Chemical composition of water and gas from five nearshore subaqueous springs in Clear Lake, 8:12213 (RA;US)
Thompson, P.A., *See* Chang, G.C., 8:12450
Thompson, R.B., NDE programs at the Ames Laboratory and Iowa State University, 8:12880 (R;US)

Thompson, R.C., 1976 Hanford americium exposure incident: overview and perspective, 8:13142 (R;US)
Thompson, T., *See* Costello, F., 8:12367
Thornton, A.L., LOVEL: a low-velocity aerodynamic heating code for flat-plates, wedges, and cones, 8:12872 (R;US)
Thorson, M.R., *See* Yoder, R.C., 8:13395
Thorup, N., Crystal structure of nitromalonamide determined by means of neutron diffraction, 8:12805 (RA;DK;In Danish)
Thumm, M., *See* Wilhelm, R., 8:13426, 8:13431
Thuot, M., *See* Goldstone, P.D., 8:13485
Thurber, W.R., Measurement techniques for high-power semiconductor materials and devices. Annual report, October 1, 1980-December 31, 1981, 8:12885 (R;US)
Tibbetts, T.A., Electronic structure of hcp lutetium, 8:12678 (R;US)
Tice, R.R., Cytogenetic effects of inhaled benzene in murine bone marrow, 8:13188 (BA;US)
Tieszen, S., *See* Merte, H. Jr., 8:12305
Tilghman, A., *See* Ouimette, D., 8:12993
Timbario, T.J., Alternative fuels - where we are today and where we need to go: status of technology, issues, requirements for R and D, 8:12586 (RA;US)
Tisdale, M., *See* Cohen, A.D., 8:11698
Tkachenko, L.M., *See* Balbekov, V.I., 8:12847
Tlamsa, J., *See* Kunceva, M., 8:12703
Tock, R.W., Characterization of supersorbent polymers for dehumidification. Final report, 8:12569 (R;US)
Todd, A.M.M., Monte Carlo studies of tandem-mirror plasmas interacting with waves in the ion-cyclotron range of frequencies (ICRF). Progress report, October 1, 1982-December 31, 1982, 8:13422 (R;US)
Todreas, N.E., *See* Wong, C.N.C., 8:12314, 8:12315
Tokita, N., Flow cytometric quantification of radiation responses of murine peritoneal cells, 8:13152 (R;US)
Tolley, H.D., *See* Carr, D.B., 8:13408
Tolokonnikov, S.V., Charge-exchange 1^+ excitations and precritical phenomena in the atomic nuclei, 8:13304 (RA;SU;In Russian)
Usage of the sum rules for a systematics of the analog and Gamow-Teller resonances in the self-consistent theory of the finite Fermi systems, 8:13358 (RA;SU;In Russian)
Tomkins, J.L., *See* Maudlin, P.J., 8:12435
Tompkins, J.A., *See* Haff, K.W., 8:11946
Toohig, T.E., *See* Sun, C.R., 8:13243
Toth, K.S., *See* Avignone, F.T. III, 8:13000
Tozzi, L., Plasma-jet ignition in a lean-burn CFR engine, 8:12645 (R;US)
Trapp, D.J., *See* Farber, M.G., 8:11877
Trasi, M.S., *See* Menon, S.V.G., 8:12338
Trauth, C.A. Jr., *See* Ellingson, A.C., 8:12469
Travelli, A., U.S. reduced enrichment research and test reactor (RERTR) program: accomplishments, plans, and schedules, 8:12371 (J;US)
Travis, C.C., *See* DeAngelis, D.L., 8:13073
Treat, C.H., Design procedure for solar industrial-process-heat systems in Texas. Final report, 8:12169 (R;US)
Treher, E.N., Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R;US)
Trent, D.S., *See* Onishi, Y., 8:13089
Trester, P., *See* McKelvey, T., 8:13476
Trinkle, E.J., *See* Hower, J.C., 8:11669
Trotsenko, V.I., *See* Derkach, A.Ya., 8:12924
Trotter, M.M., *See* Wagner, G.J., 8:13111
True, J.A., Alternative engine fuels: educational demonstration project. Final report, 8:12655 (R;US)
Ts'o, P.O.P., *See* Moyzis, R.K., 8:13114
Ts'P, P.O., *See* Moyzis, R.K., 8:13115
Tsai, M.C., Dehydrogenation processes on nickel and platinum surfaces. Conversion of cyclohexane, cyclohexene, and cyclohexadiene to benzene, 8:12810 (J;US)
Tsang, C.F., Aquifier thermal energy storage: a survey, 8:12453 (J;US)
Tsang, M.B., *See* Lynch, W.G., 8:13344
Tsay, C.S., *See* Rosenfield, A.R., 8:12705
Tseng, S.G., *See* Alexander, J.H., 8:11660
Tsibulya, A.M., *See* Manturov, G.N., 8:13351
Tuite, P.T., *See* Berlin, R.E., 8:11871
Tupy, J., *See* Kunceva, M., 8:12703
Turchi, P.J., Research needs: prime-power for high energy space systems. Final report 26 Oct 81-31 Jul 82, 8:12381 (R;US)
Turko, B., Laser-based multiparameter system for automatic sorting of microscopic particles, 8:13183 (R;US)
Turner, A., *See* White, A.L., 8:12637
Turner, A.B., *See* Ciliberti, D.F., 8:11627
Turner, F.B., Environmental effects of solar-thermal power systems: ecological observations during early testing of the Barstow 10-MWe pilot STPS, 8:12125 (R;US)
Turner, M.S., *See* Kolb, E.W., 8:13232
Turowski, P., Stability of NbTi composite superconductors of high CU/SC-ratio, 8:12848 (R;DE;In English)
Tuse, D., Regulatory mechanisms in Thielavia terrestris. Final report, 8:13134 (R;US)
Tuszewski, M., *See* Rej, D.J., 8:13440
See Spencer, R.L., 8:13442
Tvedt, T.J., Investigation of on-line chelant addition to PWR steam generators. Annual report, 1981, 8:12302 (R;US)
Tyree, W.H., Neutron dosimetry development program at Rocky Flats, 8:12990 (RA;US)

U

Uberbacher, E.C., Neutron scattering studies and modeling of high mobility group 14 core nucleosome complex, 8:13105 (J;US)
Uhrig, R.E., Electric utility criteria and decisions: coal-oil mixtures, coal-oil-water mixtures and selected advanced coal systems, 8:11758 (RA;US)
Ullrich, G., *See* Hanulik, J., 8:12382
Ulseth, J.A., *See* Gold, R., 8:12398
Urin, M.G., *See* Nikolaev, M.A., 8:13347
Usmanov, F.M., *See* Brianson, Sh.I., 8:13357
Usmanov, F.N., *See* Muminov, A.I., 8:13339
Uspenskij, M.N., *See* Artem'ev, N.A., 8:12782
Utrera, W.J., *See* McCurdy, G., 8:11969

V

Va'vra, J., Use of nitrogen laser for observation of space-charge effects in drift chambers, 8:12992 (R;US)
Vadeev, V.P., Investigation of ionization efficiency in the "Krion-1" electron-beam source, 8:12923 (R;SU;In Russian)
Vader, D.T., *See* Anderson, D.W., 8:11671
Vahala, G., Rayleigh-Schroedinger perturbation theory for unstable modes of a high-β cylindrical tokamak, 8:13463 (J;GB)
Valaoris, Z.A., Dispersion properties of spiral deflecting systems, 8:12890 (TG;US)
Study of certain plane spiral deflecting systems of traveling-wave tubes, 8:12889 (TG;US)
Vakhtel', V.M., Simplified and semisimplified α-decay of N=125 nuclei and effective nucleon-nucleon interaction, 8:13345 (RA;SU;In Russian)
Valand, T., Behavior of Al electrodes in aqueous solutions, 8:12813 (R;NO)
Valby, L., *See* Margolies, D., 8:13498
Van Den Berg, L., *See* Beyerle, A., 8:12731
See Hull, K., 8:12946
van der Burgt, M.J., *See* McCullough, G.R., 8:11585
Van Dyne, G.M., *See* Pendleton, D.F., 8:13061
Van Eck, O.J., Regional tectonics and seismicity of southwestern Iowa. Final report, 1978-1982, 8:13211 (R;US)
Van Etten, D., Capabilities of the Los Alamos National Laboratory's environmental emergency-response vehicle, 8:13042 (R;US)
van Etten, D.M., *See* Bowen, B.M., 8:13043
van Lint, V.A.J., *See* Pease, R.L., 8:12086
van Rensburg, W.C.J., *See* Rao, C.D., 8:11726
van Steenbergen, A., *See* Krinsky, S., 8:12937
Van't Hof, J., Cells of pea (Pisum sativum) that differentiate from G2 phase have extrachromosomal DNA, 8:13107 (J;US)
Vanackere, Y., *See* Le Bouteiller, J.P., 8:11822
Vanagas, V.V., Evaluation of the sd-nucleus level density in the framework of exactly solved model with strongly limited dynamics, 8:13363 (RA;SU;In Russian)
Vandenborre, H., Active electrodes to be used in advanced alkaline-water electrolysis, 8:11954 (R;BE)
Vander Molen, R.H., *See* Talty, R.D., 8:11769

Vanderlaan, M., Histochemistry of NADH diaphorase and γ-glutamyltranspeptidase in rat bladder tumors, 8:13112 (J;US)
Vangala, R., *See* Boegner, F., 8:11590
Vant-Hull, L.L., Field optimization for the solar repowering of an electric utility near Abilene, Texas. Final report, 8:12124 (R;US)
Vargas, J.I., Brazilian biomass utilization program, with emphasis on proalcool, 8:12025 (RA;BR)
Vartsky, D., *See* Cohn, S.H., 8:13059
Vasilakos, N.P., Solvent and chemical-reaction effects in supercritical extraction of coal. Fifth quarterly technical progress report, September 1-November 30, 1982, 8:11636 (R;US)
Vasilevskij, V.S., *See* Filippov, G.F., 8:13299, 8:13362
Vaz, L.E., Nonlinear nonstationary analysis with the finite element method, 8:13416 (R;DE;In German)
Vdovin, A.I., Properties of the ^{147}Eu and ^{149}Eu low-lying excited states in the framework of the semimicroscopic quasiparticle-phonon model, 8:13325 (RA;SU;In Russian)
Velen, S., *See* Gollon, P.J., 8:12999
Venkatakrishnan, R., Geological linears of the northern part of the Cascade Range, Oregon. Special paper No. 12, 8:13208 (R;US)
Venkatasetty, H.V., *See* Ebner, W.B., 8:12457
Venneri, F., *See* Stygar, W., 8:13502
Ventura, L.M., *See* Bandel, W., 8:12644
Venturini, E.L., *See* Beauchamp, E.K., 8:12715
Venturini, V., *See* Pagani, C., 8:12919
Ver Ploeg, A.J., Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R;US)
Wyoming's oil and gas industry. Public information circular No. 17, 8:11788 (R;US)
Verdier, B., Final progress report for European Modelling Group, 8:12159 (R;XE)
Vergez, Pierre, Elements of methodology for study the failures of great systems. Logical and algebraic calculus, 8:13540 (R;FR;In French)
Vermeiren, P., *See* Vandenborre, H., 8:11954
Verosub, K.L., *See* Harrington, J.M., 8:12207
Vesilind, P.A., Fundamental aspects of air classifier operation and design, 8:12631 (R;US)
Viano, G.A., *See* Di Salvo, E., 8:13303
Vibike, Kh.I., *See* Gersh, Kh.U., 8:13309
Vieth, D.L., Background and historical perspectives for monitored retrievable storage, 8:11856 (J;US)
Vigerstad, T.J., Peat resource estimation in South Carolina, 8:11714 (RA;US)
Vignes, M., *See* Durieu, L., 8:13543
Villen, R.A., Microplants for ethyl alcohol production, 8:12039 (RA;BR)
Vindelov, K.E., *See* Griffith, R.V., 8:12982
Vine, D.H., *See* Chaffin, D.J., 8:12147
Viney, C.E., Experimental and numerical studies of natural convection in a Hele-Shaw cell, 8:12873 (R;US)
Viskanta, R., *See* Anderson, D.W., 8:11671
See Fetters, G.D., 8:11680
Visuri, P.J., Technical note: handling of alarms using logic, 8:12362 (J;US)
Vitman, V.D., *See* Bykov, A.A., 8:13329
Voevodin, V.P., *See* Balakin, S.I., 8:12918
Vogler, W.R., *See* Harris, J.A., 8:12495
Vogt, G., *See* Walsh, J., 8:11959
Vogt, H.G., *See* Dorner, R., 8:13373
Vogt, S., Investigation of the influence of modified parameters in the atmospheric dispersion model on the results of the German Risk Study (DRS), 8:13040 (R;DE;In German)
Vogt, T.F., *See* Tice, R.R., 8:13188
Volkov, P., *See* Gardes, D., 8:12969
Volmyanskij, Eh.I., *See* Belen'kij, V.M., 8:13340
Von Lintig, R.D., *See* Hoyle, C.D., 8:13315
Vook, R.W., Cathodoluminescence of thorium in the presence of O_2, CO and gas mixtures of CO-O_2 and CO-H_2, 8:12695 (J;NL)
Vorob'ev, G.G., *See* Ableev, V.G., 8:12921
Voronchev, V.T., *See* Krasnopol'skij, V.M., 8:13307
Vostrikov, M.A., TRIFOB code for calculating the isotope composition change in a cylindrical reactor cell with detailed accounting for neutron spatial and energy distribution, 8:12341 (R;SU;In Russian)
Vulliet, W.V., *See* Pease, R.L., 8:12086

W

Wachter, J.W., *See* Hurrell, S.J., 8:11943
Wade, D., Unique features and operating experiences of the 1500-MW Laramie River Station utilizing Powder River Basin subbituminous coal, 8:12274 (RA;US)
Wade, D.T., Coal liquids: milestones toward commercialization, 8:11591 (RA;US)
Wadlinger, E.A., High-brightness negative-hydrogen linear accelerator, 8:12906 (R;US)
Wagner, G.J., Inducible cadmium binding complexes of cabbage and tobacco, 8:13111 (J;US)
Wahi, K.K., *See* Chu, M.S., 8:11910
Waldheim, L., Methanol from wood and peat, 8:11989 (RA;US)
Waley, H., *See* Lee, G.K., 8:11722
Walia, D.S., *See* Wolfe, R.A., 8:11742
Walke, W.C., Compressed-air energy storage preliminary design and site-development program in an aquifer. Volume 4. Aquifer geology. Final report, 8:12449 (R;US)
Walker, D.W., *See* Gaggioli, R., 8:12521
Walker, H., *See* Gudiksen, P., 8:13196
Walker, H.W., Isotope effects in the infrared spectra of the metal carbonyl hydride/deuteride anions (H/D)M(CO)$_4^-$ (M = Fe, Ru, or Os), 8:12798 (J;US)
Walker, P.L., *See* Given, P.H., 8:11613
Wall, B.D., High pressure wet carbonization of peat, 8:11608 (RA;US)
Wallace, S.L., *See* Tvedt, T.J., 8:12302
Waller, J., *See* McCullough, G.R., 8:11585
Waller, L.H., Gunnison County airport terminal (Project Number 339). Final report, 8:12152 (R;US)
Wallwork-Barber, K.M., *See* Wenzel, W.J., 8:13065
Walsh, J., Demonstration of landfill gas-enhancement techniques in landfill simulators, 8:11959 (R;US)
Walter, G., Population probabilities of excited states in radioactive nuclei for s-process studies, 8:13229 (R;DE)
Walter, K., Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA;US)
Walters, A., Evaluation of environmental issues on the use of peat as an energy source, 8:11690 (RA;US)
Walters, W.B., Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R;US)
Walters, W.H., *See* Onishi, Y., 8:13090
Walton, J.T., *See* Fong, A., 8:12997
Wampler, D.L., *See* Schettler, P.D. Jr., 8:11824
Wan, E.I., Technical and economic assessment of liquid-fuel production from biomass, 8:12074 (RA;US)
Wang, C.L., Debye shielding of a moving test charge in plasma, 8:13461 (J;GB)
Wang, G.C., Determination of miscibility pressure by direct-observation method. Quarterly report, July 1-September 30, 1982, 8:11797 (R;US)
Wang, R.C., *See* Beck, S.R., 8:12069
Wang, S.W., Study of transition boiling phenomena with saturated water at 1-4 bar, 8:12874 (D;US)
Ward, R.W., *See* Young, C.Y., 8:12206
Warren, D.H., Seismic-refraction measurements of crustal structure near Santa Rosa and Ukiah, California, 8:12208 (RA;US)
Warren, L., *See* Nouffi, R., 8:12093
Wartman, B.L., *See* Harris, K.L., 8:12198
Warwick, A., *See* Gutbrod, H.H., 8:13297
Warwick, R.G., *See* Smith, T.A., 8:12354
Wasan, D., Interfacial phenomena in enhanced oil recovery, 8:11799 (B;US)
Wasan, D.T, Oil banking phenomena in surfactant/polymer and caustic flooding: droplet coalescence and entrapment processes, 8:11805 (J;US)
Watanabe, T., *See* Fisch, N.J., 8:13454
Watson, D.E., *See* Hooper, R.J., 8:11724
Watson, F.V., Notes on multigroup diffusion kinetics, 8:12343 (R;BR)
Watts, J.R., *See* Corey, J.C., 8:13067
Watts, K.D., *See* Spampinato, P.T., 8:13465
Weatherby, J.L. Jr., Input-output and risk analysis for a regional energy-development bank. Final report, 8:12467 (R;US)
Weaver, D.C., *See* Lineback, N.G., 8:13072
Webb, R.B., Nonreciprocal synergistic lethal interaction between 365-nm and 405-nm radiation in wild type and uvrA strains of Escherichia coli, 8:13164 (J;GB)
Webb, R.C., *See* McIntyre, P.M., 8:12947
Weber, E.T., *See* Krupar, J.J., 8:12445
Weber, M.J., *See* Cline, C.F., 8:12742
Weber, S.L., *See* Mudge, L.K., 8:12067

Weckermann, F., *See* Herkenrath, H., 8:12290
Wei, J.L., *See* Solomon, D.E., 8:13471
Weibrecht, R., *See* Hohmuth, K., 8:12472
Weik, F., *See* Gutbrod, H.H., 8:13297
Weingerten, R., *See* Eisen, Y., 8:12985
Weinland, S.L., *See* Gourdin, W.H., 8:12716
Weisberg, A.H., *See* Herman, I.P., 8:12887
Weise, H., Lignite in Europe: use, present and future production, 8:11735 (RA;US)
Weixelbaum, K., *See* Raeuchle, E., 8:13425
Welcomer, T.D., Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R;US)
Weldon, W.F., Pulsed hompolar generator research at the University of Texas at Austin, 8:13469 (R;US)
TEXT energy-storage system, 8:13464 (R;US)
See Brennan, M., 8:13470
Weller, S.W., Evaluation of combustion and cleanup of SRC-II coal-derived liquid fuel, 8:11679 (R;US)
Wells, C.V., Challenge for metrology in the R and D environment, 8:12942 (R;US)
Wen, C.Y., *See* Alexander, J.H., 8:11660
Wender, I., *See* Deshpande, G.V., 8:11634
Wender, S.A., Bismuth germanate as a high-energy gamma-ray detector, 8:12971 (R;US)
Wengeler, H., Incorporation of atomic carbon and hydrogen in high-melting oxide - nuclear-chemical, dilatometric and infrared spectroscopical investigations on C- and H-doped MgO and CaO-monocrystals, 8:12710 (R;DE;In German)
Wenzel, W.J., Texas Panhandle soil-crop-beef food chain for uranium: a dynamic model validated by experimental data, 8:13065 (R;US)
Werb, Z., Degradation of connective tissue matrices by macrophages. III. Morphological and biochemical studies on extracellular, pericellular, and intracellular events in matrix proteolysis by macrophages in culture, 8:13123 (J;US)
See Jones, P.A., 8:13116
Weres, O., Prediction of chemical problems in the reinjection of geothermal brines, 8:12238 (J;US)
Wesely, M.L., *See* Eastman, J.A., 8:13035
Weseman, M., Training farmworkers for industrial jobs: a longitudinal study, 8:12466 (R;US)
Wessling, F.C., *See* Chaffin, D.J., 8:12147
Wessol, D.W., *See* Wheeler, F.J., 8:12339
West, C.D., Two-phase, two-component Stirling engine with controlled evaporation, 8:12648 (R;US)
See Livingston, R.S., 8:12490
West, D.C., *See* Shugart, H.H. Jr., 8:13056
Wester, H.J., CHP: planning, technology, costs; the application of combined heat and power in a medium-sized city, 8:12642 (TJ;GB)
Westfall, R.M., *See* Renier, J.P., 8:12438
Wetmiller, R.J., *See* Lyons, J.A., 8:13210
Wetzel, O.K. Jr., Solar-assisted heat pumps and alternative-energy-awareness demonstration. Final report, 8:12172 (R;US)
Whale, A.V., Development and installation of a 2-kW photovoltaic array at Poynton, nr Manchester. Final report, 8:12059 (R;XE)
Whalen, J.F., *See* Smith, A.B., 8:13319
Whealton, J.H., ORNL neutral-beam program in 1978, 8:13490 (R;US)
Wheat, B.M., *See* McGavran, L.P., 8:13554
Wheeler, F.J., Raffle V general purpose Monte Carlo code for neutron and gamma transport, 8:12339 (R;US)
Wheeler, R.V., Experience and values in multi-dosimeter techniques, 8:12988 (RA;US)
Whelan, J.A., *See* Austin, C.F., 8:12184
Whitacre, J.A., Demonstrate use of solar energy for laundromat washing and drying. Final report, 8:12171 (R;US)
Whitaker, S.D., Analyses of meteorological and insolation data useful for solar energy system design, 8:12008 (RA;CH)
White, A.B. Jr., *See* Boland, W.R., 8:13553
White, A.L., Co-utilization of municipal solid waste and wood residues for small-scale resource recovery: a preliminary assessment, 8:12637 (R;US)
White, D.E., *See* Sims, J.D., 8:12214
White, D.H., Geothermal development plan: Maricopa County, 8:12230 (R;US)
Geothermal development plan: Pima County, 8:12231 (R;US)
Geothermal development plan: northern Arizona counties, 8:12232 (R;US)
Geothermal development plan: Pinal County, 8:12233 (R;US)
Geothermal development plan: Cochise/Santa Cruz Counties, 8:12234 (R;US)
Geothermal development plan: Yuma County, 8:12235 (R;US)
Geothermal development plan: Graham/Greenlee Counties, 8:12236 (R;US)
Potential of utilization of geothermal energy in Arizona. Executive summary, 8:12185 (R;US)
See Abe, K., 8:13253
White, D.M., Status of Gulf Coast lignite activity, 8:11721 (RA;US)
See Kube, W.R., 8:11718
See Leonard, R.L., 8:12273
White, R.M., *See* Haight, R.C., 8:12909
White, S.K., *See* Drury, J.S., 8:13084
See Lee, S.Y., 8:13086
White, T., Bonneville Power Administration's solar domestic hot water monitoring program - program administration and technical issues, 8:12142 (RA;US)
Whitley, R.H., *See* Garner, J.K., 8:13519
See Youssef, M.Z., 8:13520
Whitman, G.D., Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982, 8:12294 (R;US)
See Cheverton, R.D., 8:12439
Whitmoyer, D.E., Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R;US)
Whitt, J.M., *See* Lloyd, W.G., 8:11672
Whorton, E.B. Jr., Parametric statistical methods and sample-size considerations for dominant lethal experiments: the use of clustering to achieve approximate normality, 8:13179 (R;US)
Wickham, L.E., Waste classification system for low-level radioactive wastes, 8:11882 (R;US)
Wiczer, J.J., *See* Osbourn, G.C., 8:13004
Wieczorek, H., *See* Damerau, G., 8:11885, 8:11886
See Stojanik, B., 8:11884
Wiedemann, H., *See* Bulos, F., 8:12897
Wieferman, J., *See* Weatherby, J.L. Jr., 8:12467
Wiegel, J., Clostridium thermoautotrophicum species novum, a thermophile producing acetate from molecular hydrogen and carbon dioxide, 8:12105 (J;US)
See Ljungdahl, L.G., 8:13135
Wieland, B.W., *See* Bair, J.K., 8:13314
Wieland, C.C., *See* Griffin, G.M., 8:11704
Wieliczka, D.M., Photoemission study of the 4f character in gamma- and alpha-cerium, 8:12680 (R;US)
Wielopolski, L., *See* Cohn, S.H., 8:13059
Wieman, H., *See* Gutbrod, H.H., 8:13297
Wierman, R.W., *See* Klos, D.B., 8:13532
Wilcox, W.J. Jr., Uranium enrichment, 8:12474 (R;US)
Wilde, R.T., Conceptual design of monitored retrievable storage facilities, 8:11859 (J;US)
Wilhelm, R., HECTOR, a high voltage belt pinch experiment, 8:13426 (RA;DE;In German)
HECTOR experiment (high voltage belt pinch), 8:13431 (RA;DE;In German)
Wilkerson, J.F., Energy calibration of the TUNL dual-90° magnet analyzing system, 8:12915 (R;US)
Wilkins, D.E., Systems model of the iron oxide hot gas clean-up process. Volume II. Hotgas user's manual. Final report, September 1979-December 1980, 8:11661 (R;US)
See Alexander, J.H., 8:11660
Williams, C.D., Hydroelectric power: renewed emphasis and expanded opportunities, 8:11995 (R;US)
Williams, G.O., *See* Sun, C.R., 8:13243
Williams, J.G., *See* Brandon, W.E., 8:12991
Williams, J.H., *See* Casper, R.A., 8:12166
Williams, K.L., *See* Rice, R.C., 8:11720
Williams, P.W., *See* Koide, M., 8:13094
Williams, R.E., Procedures for multielement analysis using high-flux fast-neutron activation, 8:12767 (J;CH)
Williams, S.I., *See* Suss, H., 8:12683
Williamson, K.D. Jr., *See* Thayer, G.R., 8:12063
Wilmot, E.L., *See* Smith, R.N., 8:11853
Wilson, F.A., Preliminary investigation of accessory zircons from volcanic and sedimentary rocks from Clear Lake, 8:12253 (RA;US)
Wilson, H.T., Biomass gasification developments, 8:11990 (RA;US)
Wilson, P.B., *See* Cooper, R.K., 8:12865
Wilson, R.J. Jr., *See* Sattelberger, A.P., 8:12796
Wilson, S.K., *See* Balick, L.K., 8:13058
Wilson-Smith, N.G., Coal supply factor is it largely romance or a solid plus, 8:11773 (RA;US)

Wiltsee, G.A., RD and D initiatives for low-rank coals: follow-up to the low-rank coal study, 8:11582 (RA;US)
Wimmer, E., *See* Semelr, B.L., 8:13108
Windall, S.E., *See* Martinez, R., 8:12260
Wing, N.D., *See* Doyle, B.L., 8:12931
Winkelstein, W. Jr., *See* Selvin, S., 8:13138
Winkler, W., First comparison of the results of standard problems carried out in the blowdown region, 8:12397 (R;DE;GE)
Winter, M., Monitoring for environmental radioactivity at the Karlsruhe Nuclear Research Center in 1980, 8:13041 (R;DE;In German)
Wise, D.L., *See* Levy, P.F., 8:11668
See Ruoff, C.F., 8:11607
Wiser, W.H., Chemical aspects of structure and liquefaction of bituminous coals, 8:11675 (RA;US)
Witt, F.J., *See* Munson, L.F., 8:12418
Wittek, P., *See* Vogt, S., 8:13040
Wittrig, T.S., *See* Mahoney, J.A., 8:11629, 8:11630, 8:11631
Wohlers, D., *See* Pfenning, K.J., 8:12797
Wohletz, K.H., Origin of a sanidine-coesite grospydite, 8:13218 (R;US)
Wolfe, R.A., Benefits of coal preparation, 8:11742 (RA;US)
Wolfe, R.W., *See* Moreland, W.C., 8:12621
Wolff, S., Measurement of sister chromatid exchange in mammalian cells, 8:13192 (BA;US)
Wollenberg, H.A., Geothermal resource exploration, 8:12216 (J;US)
Wollman, F.A., *See* Joliot, P., 8:13127
Wolowski, E., *See* Specks, R., 8:11593
Wolstenholme, P., *See* Durieu, L., 8:13543
Wong, C., *See* Hansen, L.F., 8:13378
Wong, C.N.C., User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis, 8:12314 (R;US)
User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis, 8:12315 (R;US)
Wong, K.L., Radio-frequency wave trajectories for current drive in tokamak reactors, 8:13447 (R;US)
Wood, H.G. III, *See* Gunzburger, M.D., 8:11844
Wood, L.L., *See* Herman, I.P., 8:12887
Woodard, L.M., *See* Douglass, S.S., 8:12857
Woodard, S.E., *See* Haight, R.C., 8:12909
Woodle, K.A., *See* Howell, R.H., 8:12934
Woodruff, G.L., *See* Norman, E.B., 8:13227
Woodruff, W.L., Burnup-dependent cross-section data for research reactors and a comparision of REBUS-2 and PDQ-7 Burnup, 8:12377 (J;US)
Woods, R.R., 40-kW phosphoric acid fuel cell field test: project plan, 8:12541 (BA;US)
Woodson, H.H., *See* Brennan, M., 8:13470
See Weldon, W.F., 8:13464
Wosiachi, G., *See* Srivastava, K.C., 8:12029
Wray, W.O., Fast correlation method for passive-solar design, 8:12161 (R;US)
Wright, B.L., Spheromak ICRF heating studies at low power, 8:13439 (R;US)
Wright, G.T., Efficient particulate scrubber for glass melter off-gas, 8:11880 (R;US)
Wright, J.T.C., Dimensioning the role of alcohol fuels in Brazil's energy future, 8:12480 (RA;BR)
Wrobel, T.F., *See* Pease, R.L., 8:12086
Wszolek, B., *See* Kukiel, E., 8:13173
Wurm, K.J., Annotated bibliography for the design of waste packages for geologic disposal of spent fuel and high-level waste, 8:11895 (R;US)
Wynkoop, M.M., Future coal export demand and its effect on the United States market, 8:11746 (RA;US)
Wyzga, R., *See* Lihach, N., 8:12509

Y

Yabusaki, S.B., *See* Onishi, Y., 8:13090
Yadav, S., *See* Thompson, J.M., 8:12213
Yaggee, F.L., SEM-TEM Sampling technique for use with fuel LWR cladding, 8:12432 (J;US)
Yakupkovic, J., *See* Jordan, J., 8:11670
Yanetz, A., *See* Manes, A., 8:12006
Yang, V., Outlook for methanol in Brazil, 8:12510 (RA;US)
Yang, Y., Laser excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons, 8:12758 (R;US)
Yarbrough, D.W., *See* McElroy, D.L., 8:12558
Yates, L.P., *See* Lloyd, W.G., 8:11672
Yauger, R.L., *See* Bowan, R.C. Jr., 8:12719
Yeh, G.T., FECWASTE: user's manual of a Finite-Element Code for simulating WASTE transport through saturated-unsaturated porous media. Environmental Sciences Division Publication No. 1907, 8:11926 (R;US)
See DeAngelis, D.L., 8:13102
Yemans, M., *See* Kirschner, C., 8:12160
Yen, T.F., *See* Jang, L.K., 8:12772
Ying, D.H.S., Gas/slurry flow in coal-liquefaction processes (fluid dynamics in a three-phase-flow column). Final technical progress report, 1 October 1979-31 March 1982, 8:11616 (R;US)
Yoder, R.C., Status of current neutron dosimeter performance analyses, 8:13395 (RA;US)
Yoshimura, H.R., *See* May, R.A., 8:12863
Yoshiyama, R.M., Distribution and abundance patterns of rocky intertidal fishes in central California, 8:13077 (J;NL)
Young, A., *See* Malachesky, P.A., 8:12651
Young, C., *See* Ouimette, D., 8:12993
Young, C.Y., Attenuation of teleseismic P waves in the Geysers-Clear Lake region, 8:12206 (RA;US)
Young, D.C., *See* Cronauer, D.C., 8:11628
Young, J.A., Evaluation of experiences in long-term radon and radon-daughter measurements, 8:13044 (R;US)
Young, J.E., Processing of liquid hydrocarbons for fuel cell applications, 8:12538 (BA;US)
Young, K.G., Communications interface for the PDP-11 and the Nuclear Data 6600, 8:13444 (R;US)
ND6600 computer in fusion-energy research, 8:13445 (R;US)
Young, R.K., Recent developments in high pressure, entrained flow, slagging gasification of coal update of Bi-Gas Pilot Plant Operations, 8:11589 (RA;US)
Youngberg, A.D., Depositional environments, subsurface stratigraphy, and post-burn characterization of the Paleocene-Eocene Hanna formation at the Hanna, Wyo UCG site: Hanna III experiment, 8:11623 (R;US)
See Ethridge, F.C., 8:11622
Youngblood, E.L., *See* Johnson, J.K., 8:11655, 8:11656
Yount, J.A., *See* Klos, D.B., 8:13532
See Shen, E.J., 8:13482
Yourd, R., *See* Abbott, S., 8:12896
Youssef, M.Z., Cross-section sensitivity analysis for a tandem mirror hybrid reactor and considerations regarding new ^{9}Be (n, 2n) cross-section evaluations, 8:13520 (J;US)
Yu, J.F., *See* Beck, S.R., 8:12069
Yu, L.H., *See* Krinsky, S., 8:12937
Yue, D.D., BWR 4/Mark I accident sequences assessment, 8:12415 (R;US)
Yuen, M.J., Energy transfer in self-assembled chlorophyll a systems, 8:13110 (J;GB)
Yurkewycz, R., Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R;US)
Yuta, H., *See* Kitagaki, T., 8:13257

Z

Zabransky, R.F., *See* Kosowski, G.M., 8:12072
Zahn, H.S., Remote systems requirements for tandem-mirror fusion power reactors, 8:13531 (J;US)
Zak, B.D., *See* Homann, P.S., 8:13157
Zalosh, R.G., Effect of water fogs on the deliberate ignition of hydrogen. Final report, 8:12831 (R;US)
Zambrano, T.G., *See* Radkey, R.L., 8:12126
Zaparov, Eh.A., *See* Artemov, S.V., 8:13317
Zaplatin, E.N., *See* Glazov, A.A., 8:12920
Zaplatin, N.L., *See* Alenitskij, Yu.G., 8:12902
See Glazov, A.A., 8:12895
Zarubin, P.P., Parameter of nuclear level density spin dependence in the range A approximately 100, 8:13332 (RA;SU;In Russian)
Zatorski, R.A., *See* Berndt, C.C., 8:12708
Zee, A., *See* Seckel, D., 8:13275
Zeigler, C.C., Interpretation of low-level environmental radioactivity measurements, 8:13038 (R;US)
Zeitz, L., *See* Laughlin, J.S., 8:13380
Zhalov, M.B., RPA description of isoscalar resonances in nonmagic nuclei, 8:13327 (RA;SU;In Russian)
Zhdanov, V.S., *See* Babenkov, M.I., 8:13239
Zhuravleva, N.A., *See* Kal'ner, V.D., 8:12672

Zijp, W.L., COMFIT. A computer program for determining best fitting curves, 8:13548 (R;NL)

Zimmer, P.B., *See* McChesney, M.A., 8:12176

Zimmerman, E.S., *See* Pratt, D.C., 8:12095

Zipperian, T.E., *See* Fritz, I.J., 8:12741

Zolotar, B.A., *See* Chexal, V.K., 8:12425

Zumbrunnen, D.A., *See* Anderson, D.W., 8:11671

SUBJECT INDEX

The subject index is based on the use of subject descriptors selected from a controlled thesaurus of terms (DOE/TIC-7000). Subject descriptors and qualifiers (subheadings) are selected and presented in the following format:

SUBJECT DESCRIPTOR
Qualifier
Title, (supplementary information), citation number, (R:US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

A

A RESONANCES
For A3 resonances use PI-1640 RESONANCES.
Particle Production
Double Regge exchange in rho $\Delta\pi$ and rho rho N final states from π^- p interactions at 8 GeV/c, 8:13257 (R:US)

ABSOLUTE COUNTING
Automation
Evaluation of a commercial, semi-automatic system for counting tracks in solid state nuclear detectors used for personnel dosimetry, 8:12983 (RA:US)

ABSORBED DOSES
See RADIATION DOSES

ACCELERATOR FACILITIES
4 π physics with the plastic ball, 8:13297 (R:US)
Physics Division annual review, 1 April 1980-31 March 1981, 8:13293 (R:US)
Sizes and shapes of short-lived nuclei via laser spectroscopy. Progress report, January 31, 1981-July 31, 1982, 8:12916 (R:US)
Magnetic Spectrometers
Analysis of the spectrometer SPES 4 and study of an associated detection apparatus, 8:12927 (R:FR:In French)
Facility for measurements of fragmentation spectra of relativistic deuterons and alpha particles, 8:12921 (R:SU:In Russian)

ACCELERATORS
See also COLLECTIVE ACCELERATORS
ELECTROSTATIC ACCELERATORS
HEAVY ION ACCELERATORS
LINEAR ACCELERATORS
PARTICLE BEAM FUSION ACCELERATOR
Electromagnets
Radiation-resistent magnets, 8:12914 (R:XC)

ACCIDENTAL INTAKE
See ACCIDENTS

ACCIDENTAL IRRADIATION
See RADIATION ACCIDENTS

ACCIDENTS
See also RADIATION ACCIDENTS
REACTOR ACCIDENTS
Environmental Impacts
Accident-generated aerosols: assessment methodology (Review of methods for estimating quantity and characteristics of accident-generated aerosols), 8:13031 (R:US)
Neutron Dosimetry
Calculations on neutron dosimetry at the Chalk River Nuclear Laboratory, 8:13397 (RA:US)
Statistics
Truck accident and fatality rates calculated from California highway accident statistics for 1980 and 1981, 8:11853 (R:US)

ACETATES
Biosynthesis
Clostridium thermoautotrophicum species novum, a thermophile producing acetate from molecular hydrogen and carbon dioxide, 8:12105 (J:US)
Ion Exchange Chromatography
Applications of ion chromatography, 8:12747 (R:US)

ACETYLENE
Molecular Beams
Molecular-beam photoionization studies of molecules and their van der Waals clusters, 8:12815 (R:US)
Oxidation
Toward a comprehensive chemical kinetic mechanism for the oxidation of acetylene: comparison of model predictions with results from flame and shock tube experiments, 8:11965 (RA:US)
Polymerization
Agglomeration of polyacetylenic particulates and its relation to soot formation, 8:12821 (RA:US)
Radiolysis
Agglomeration of polyacetylenic particulates and its relation to soot formation, 8:12821 (RA:US)

ACID ELECTROLYTE FUEL CELLS
Field Tests
40-kW phosphoric acid fuel cell field test: project plan, 8:12541 (BA:US)
Performance Testing
Develop and test fuel-cell-powered on-site integrated total-energy systems: Phase III, full-scale power plant development. 5th quarterly report, February-April, 1982, 8:12522 (R:US)

ACID RAIN
Environmental Impacts
Acid rain: a background report, 8:13029 (R:US)
Risk Assessment
Acid deposition in Texas: technical summary and perspective. Final report, 8:13033 (R:US)

Plan to evaluate acid-deposition issues in the state of Texas. Final report, 8:13032 (R:US)

ACIDS (INORGANIC)
See INORGANIC ACIDS

ACOUSTIC EMISSION TESTING
Data Processing
Acoustic-emission linear-pulse holography, 8:12881 (R:US)
Holography
Acoustic-emission linear-pulse holography, 8:12881 (R:US)

ACOUSTIC MONITORING
Performance
Subsurface subsidence damage monitoring: acoustic tomography and microgravimetry, 8:13060 (R:US)

ACRYLIC ACID ESTERS
Materials Testing
Uv protective coatings for heliostats and the plastic dome. Final technical report, 8:12119 (R:US)

ACRYLONITRILE
Sorption
Characterization of supersorbent polymers for dehumidification. Final report, 8:12569 (R:US)

ACTINIDE NUCLEI
See also AMERICIUM 241
CALIFORNIUM 252
NEPTUNIUM 237
PLUTONIUM 234
PLUTONIUM 238
PLUTONIUM 239
PLUTONIUM 240
THORIUM 232
URANIUM 233
URANIUM 235
URANIUM 238
Energy Levels
States of negative parity in even-even nuclei, 8:13353 (RA:SU:In Russian)

ACTINIUM B
See LEAD 211

ACTINIUM C
See BISMUTH 211

ACTINOMYCIN
Biological Effects
Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture, 8:13116 (J:US)

ACTIVATION ANALYSIS
Documentation
Paper prediction versus reality at the 1981 Modern Trends in Activation Analysis Conference, 8:12763 (J:CH)
Information Dissemination
Paper prediction versus reality at the 1981 Modern Trends in Activation Analysis Conference, 8:12763 (J:CH)
Interference
Interference control in low-level ^{129}I analysis, 8:12770 (J:CH)
Prompt Gamma Radiation
Physical basis for prompt-neutron activation analysis, 8:12749 (R:US)

ADENOCARCINOMAS
See CARCINOMAS

ADGEZATOR
See ELECTRON-RING ACCELERATORS

ADHESIVES
See also HALTHANE
Materials Testing
Uv protective coatings for heliostats and the plastic dome. Final technical report, 8:12119 (R:US)

ADMINISTRATION
See MANAGEMENT

ADRIAMYCIN
See DOXORUBICIN

ADSORBENTS
See also MOLECULAR SIEVES
SILICA GEL
Regeneration
Studies on the regeneration of sulfided iron oxide sorbent with steam-air mixtures. Final technical report, 8:11626 (R:US)
Sulfidation
Studies on the regeneration of sulfided iron oxide sorbent with steam-air mixtures. Final technical report, 8:11626 (R:US)

ADU
See AMMONIUM URANATES

AEROSOL MONITORING
Automation
Laser-based multiparameter system for automatic sorting of microscopic particles, 8:13183 (R:US)

AEROSOLS
See also RADIOACTIVE AEROSOLS
Chemical Analysis
New analytical techniques for mycotoxins in complex organic matrices, 8:12757 (R:US)
Decontamination
Efficient particulate scrubber for glass melter off-gas, 8:11880 (R:US)
X-Ray Diffraction
X-ray powder diffraction system for chemical specification of particulate aerosol samples, 8:12764 (J:NL)

AFLATOXIN
Extraction Chromatography
New analytical techniques for mycotoxins in complex organic matrices (Aflatoxins B1, B2, G1, and G2), 8:12757 (R:US)
Fluorescence Spectroscopy
New analytical techniques for mycotoxins in complex organic matrices (Aflatoxins B1, B2, G1, and G2), 8:12757 (R:US)
Solvent Extraction
New analytical techniques for mycotoxins in complex organic matrices (Aflatoxins B1, B2, G1, and G2), 8:12757 (R:US)
Thin-Layer Chromatography
New analytical techniques for mycotoxins in complex organic matrices (Aflatoxins B1, B2, G1, and G2), 8:12757 (R:US)

AFTER-HEAT
Nuclear Data Collections
ENDF/B fission-product data, 8:13321 (R:US)

AFTER-HEAT REMOVAL
Heat Transfer
Effect of physical characteristics on heat transfer over a gas free-flowing interface, 8:12384 (R:DE:GE)
Experimental study of heat transfer in 1- and 2-layered fluid systems perfused by gas and containing internal heat sources, 8:12385 (R:DE:GE)

AGE ESTIMATION
Thermoluminescence
Characteristics of thermoluminescence glow curves for materials exhibiting more than one glow peak, 8:12818 (R:US)

AGRICULTURAL RESIDUES
See AGRICULTURAL WASTES

AGRICULTURAL WASTES
See also MANURES
Gasification
On-site energy production from agricultural residues. Final report, 8:12104 (R:US)
Harvesting
Different perspective, 8:12088 (RA:US)
Pyrolysis
Gas turbine demonstration of pyrolysis-derived fuels, 8:12080 (RA:US)
Waste Transportation
Levelized life-cycle costs for four residue-collection systems and four gas-production systems, 8:12063 (R:US)

AGRICULTURE
Energy Balance
Evaluation of energy expenditures in the agricultural phase of some crops, 8:12031 (RA:BR)

AIR
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
Dehumidification
Micro-macropore model for sorption of water on silica gel in a dehumidifier, 8:12175 (J:GB)

AIR CONDITIONERS
See also SOLAR AIR CONDITIONERS

Cold Storage
Development of the commercial air conditioning with thermal-energy-storage concept: Phase I. Final report, 8:12572 (R:US)
Design
Development of a method to improve the efficiency of commercial and residential air-conditioning systems. Final report, 8:12574 (R:US)
Economic Analysis
Development of the commercial air conditioning with thermal-energy-storage concept: Phase I. Final report, 8:12572 (R:US)
Economics
Development of a method to improve the efficiency of commercial and residential air-conditioning systems. Final report, 8:12574 (R:US)
Evaporative Cooling
Controlled testing of retrofit energy-saver-brand indirect evaporative cooling systems. Final report, 8:12575 (R:US)
Field Tests
Controlled testing of retrofit energy-saver-brand indirect evaporative cooling systems. Final report, 8:12575 (R:US)
Performance
Development of the commercial air conditioning with thermal-energy-storage concept: Phase I. Final report, 8:12572 (R:US)
Performance Testing
Development of a method to improve the efficiency of commercial and residential air-conditioning systems. Final report, 8:12574 (R:US)

AIR INFILTRATION
Equations
Measured effect of forced ventilation on house infiltration rate, 8:12559 (R:US)
Testing
Measured effect of forced ventilation on house infiltration rate, 8:12559 (R:US)

AIR POLLUTION
Biological Effects
Monitoring ambient air for mutagenicity using the higher plant Tradescantia, 8:13186 (BA:US)
Genetic Effects
Monitoring ambient air for mutagenicity using the higher plant Tradescantia, 8:13186 (BA:US)
Monitoring
EDS coal liquefaction process development. Phase V. ECLP industrial hygiene program. Interim report, 8:11599 (R:US)
Mutagen Screening
Monitoring ambient air for mutagenicity using the higher plant Tradescantia, 8:13186 (BA:US)

AIR POLLUTION CONTROL
Use this term for items that involve the removal or management of pollutants after they are formed by a source.
Cost Benefit Analysis
Bubbles, existing and new under the Clean Air Act (Compliance based on total plant emission rather than limits on each boiler), 8:13051 (RA:US)

AIR SAMPLERS
Evaluation
Pitfalls in air sampling for radioactive particulates, 8:13049 (BA:US)

AIR SOURCE HEAT PUMPS
Computerized Simulation
Groundwater-source heat-pump design development: consideration of locally variable factors. Final report, 8:12580 (R:US)
Defrosting
Laboratory evaluation of the heating capacity and efficiency of a high-efficiency, air-to-air heat pump with emphasis on frosting/defrosting operation, 8:12563 (R:US)
Performance
Groundwater-source heat-pump design development: consideration of locally variable factors. Final report, 8:12580 (R:US)
Performance Testing
Laboratory evaluation of the heating capacity and efficiency of a high-efficiency, air-to-air heat pump with emphasis on frosting/defrosting operation, 8:12563 (R:US)

AIR TRANSPORT
Energy Conservation
Aircraft/air carrier energy conservation measures, status and operational constraints to additional implementation, 8:12592 (RA:US)
Fuel Consumption
Airlines and fuel conservation: doing more with less, 8:12606 (RA:US)

AIRBORNE PARTICLES
See PARTICULATES

AIRBORNE PARTICULATES
See PARTICULATES

AIRCRAFT
Design
Studies of energy efficient advanced transport aircraft for beyond 1990, 8:12591 (RA:US)
Economic Analysis
Aircraft/air carrier energy conservation measures, status and operational constraints to additional implementation, 8:12592 (RA:US)
Energy Efficiency
Studies of energy efficient advanced transport aircraft for beyond 1990, 8:12591 (RA:US)
Fuel Consumption
Aircraft/air carrier energy conservation measures, status and operational constraints to additional implementation, 8:12592 (RA:US)
Fuel Economy
Energy conservation - pilot's viewpoint, 8:12608 (RA:US)
Energy impact of FAA regulations and operating procedures: an operator's viewpoint, 8:12605 (RA:US)
Strategies for saving airline fuel, 8:12607 (RA:US)
Fuel Substitution
Studies of energy efficient advanced transport aircraft for beyond 1990, 8:12591 (RA:US)
Regulations
Strategies for saving airline fuel, 8:12607 (RA:US)

AIRCRAFT ACCIDENTS
See ACCIDENTS

AIR-FUEL RATIO
See FUEL-AIR RATIO

AIRPORTS
Design
Studies of energy efficient advanced transport aircraft for beyond 1990, 8:12591 (RA:US)
Direct Gain Systems
Gunnison County airport terminal (Project Number 339). Final report, 8:12152 (R:US)
Energy Conservation
Gunnison County airport terminal (Project Number 339). Final report, 8:12152 (R:US)
Photovoltaic Power Supplies
Intermediate photovoltaic system application experiment operational performance report. Volume 1. Dallas-Fort Worth Regional Airport, TX, July 1982, 8:12113 (R:US)
Trombe Walls
Gunnison County airport terminal (Project Number 339). Final report, 8:12152 (R:US)

ALABAMA
Coal Deposits
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Ethanol Plants
Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Appendices. Market survey and economic analysis, 8:11979 (R:US)
Feasibility study of a 40-MGY/80-MGY fuel alcohol production plant. Equipment data: vendor correspondence and catalog cuts, 8:11974 (R:US)
Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 2. Technical concept, 8:11977 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 1. Appendices. Executive overview, 8:11976 (R:US)
Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Market survey and economic analysis, 8:11978 (R:US)
Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 1. Executive overview, 8:11975 (R:US)

Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)

Land Use
Land use/mineral rights map series, 8:13072 (R:US)

Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)

Mineral Rights
Land use/mineral rights map series, 8:13072 (R:US)

Peat
Alabama peat resources project, 8:11702 (RA:US)

Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)

ALAP
See RADIATION PROTECTION

ALARA
All exposures shall be kept as low as reasonably achievable, economic and social factors being taken into account.

Recommendations
Analysis of a proposed one thousand dollar per man-rem cost-effectiveness criterion, 8:12416 (R:US)

ALARM DOSEMETERS
See RADIATION MONITORS

ALARM SYSTEMS

Equipment Interfaces
Technical note: handling of alarms using logic, 8:12362 (J:US)

Human Factors Engineering
Technical note: handling of alarms using logic, 8:12362 (J:US)

ALASKA

Coal Deposits
Alaska peat resource estimate, 8:11703 (RA:US)

Geological Surveys
State resource estimation: Alaska, 8:11693 (RA:US)

Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)

Peat
Alaska peat resource estimate, 8:11703 (RA:US)
Peat commercialization projects in Maine and Alaska, 8:11782 (RA:US)
State resource estimation: Alaska, 8:11693 (RA:US)

ALBEDO-NEUTRON DOSEMETERS

Calibration
Application of a single sphere albedo technique in stray neutron fields, 8:12986 (RA:US)
Feasible neutron dosimeter for stray neutron fields at PWRS, 8:12989 (RA:US)
Progress in albedo neutron dosimetry using TLD and track etch detectors, 8:12987 (RA:US)

Design
Neutron dosimetry development program at Rocky Flats, 8:12990 (RA:US)

Energy Dependence
Application of a single sphere albedo technique in stray neutron fields, 8:12986 (RA:US)
Developments in solid state detectors for personnel neutron dosimetry, 8:12982 (RA:US)
Experience and values in multi-dosimeter techniques, 8:12988 (RA:US)
Neutron dosimetry development program at Rocky Flats, 8:12990 (RA:US)

Performance
Results of routine monitoring with albedo-dosemeters, 8:12959 (RA:DE:In German)
State of the art in Albedo-neutron dosimetry, 8:12958 (RA:DE:In German)

Sensitivity
Developments in solid state detectors for personnel neutron dosimetry, 8:12982 (RA:US)

Spectral Response
Progress in albedo neutron dosimetry using TLD and track etch detectors, 8:12987 (RA:US)

ALBITE

Phase Studies
Calorimetric evidence for ideal mixing of silicon and germanium in glasses and crystals of sodium feldspar composition, 8:13222 (J:US)

ALCATOR DEVICE

Energy Balance
Role of radiation on the power balance of the Alcator C tokamak, 8:13423 (R:US)

Neutron Detection
Numerical modeling of a fast-neutron collimator for the Alcator A fusion device, 8:13474 (R:US)

ALCOHOL FUELS
Use for pure alcohols, alcohol-water mixtures, or alcohols with additives; for alcohol-gasoline mixtures, use GASOHOL.
See also ETHANOL FUELS
METHANOL FUELS
Brazilian biomass utilization program, with emphasis on proalcool, 8:12025 (RA:BR)
International outlook of Otto versus diesel cycle engine for operation on biomass fuels, 8:12652 (RA:BR)

Biological Effects
Biological impacts of alcohol fuel emission on selected pollinator, predatory and nutrient-cycling insects and arachnids, 8:13177 (RA:BR)

Environmental Impacts
Assessment of environmental impacts of production, distribution and utilization of alcohol and biomass fuels, 8:12026 (RA:BR)
Comparative assessment of the environmental and health effects associated with selected synthetic and alcohol fuel production/conversion technologies, 8:12032 (RA:BR)
Impact of biomass-derived energy programs, 8:12034 (RA:BR)

Feasibility Studies
Economic feasibility of agricultural alcohol production, 8:12035 (RA:BR)

Meetings
IV international symposium on alcohol fuels technology, 8:12024 (R:BR)

National Program Plans
Impact of biomass-derived energy programs, 8:12034 (RA:BR)

Production
Distilling alcohol with waste automobile heat. Final report, 8:12617 (R:US)

Technology Assessment
Alternative fuels - where we are today and where we need to go: status of technology, issues, requirements for R and D, 8:12586 (RA:US)
Comparative assessment of the environmental and health effects associated with selected synthetic and alcohol fuel production/conversion technologies, 8:12032 (RA:BR)

ALCOHOLS
See also ETHANOL
HEXANOLS
METHANOL
PROPANOLS

Phase Studies
Ultra-low IFT, phase behavior and microstructure in oil/brine/surfactant/alcohol systems, 8:11802 (J:US)

Structural Chemical Analysis
Liquid crystals and microemulsions in oil recovery, 8:11801 (J:US)

Synthesis
Catalysts for alcohols from biomass (C_2-C_4 alcohols), 8:11970 (R:US)

ALDEHYDO ACIDS
See CARBOXYLIC ACIDS

ALFALFA
Energy Source Development
Forage crops can be a source of ethanol, 8:12106 (J:US)
ALGAE
Anaerobic Digestion
Demonstration of solar-energy conversion of agricultural or industrial wastes to fuels. Final report, 8:12099 (R:US)
Cultivation
Cultivation of macroscopic marine algae, 8:12096 (R:US)
Fermentation
Demonstration of solar-energy conversion of agricultural or industrial wastes to fuels. Final report, 8:12099 (R:US)
Harvesting
Demonstration of solar-energy conversion of agricultural or industrial wastes to fuels. Final report, 8:12099 (R:US)
Production
Demonstration of solar-energy conversion of agricultural or industrial wastes to fuels. Final report, 8:12099 (R:US)
ALKALI METAL COMPLEXES
See also CESIUM COMPLEXES
SODIUM COMPLEXES
Crystal Doping
New class of saturable absorbers at 10.6 μm based on doped alkali halides, 8:12744 (J:US)
ALKALI METAL COMPOUNDS
See also LITHIUM COMPOUNDS
SODIUM COMPOUNDS
Catalytic Effects
Catalyzed gasification of coal: isotope and XPS studies, 8:11644 (R:US)
ALKALI METALS
See also CESIUM
LITHIUM
POTASSIUM
RUBIDIUM
SODIUM
Electron Collisions
Relativistic electron bremsstrahlung in the resonance electromagnetic field, 8:13240 (RA:SU:In Russian)
ALKALINE EARTH METAL COMPOUNDS
See also BARIUM COMPOUNDS
Catalytic Effects
Catalyzed gasification of coal: isotope and XPS studies, 8:11644 (R:US)
ALKANES
See also DECANE
METHANE
Gas Chromatography
Separation of asphaltenes using high-resolution supercritical-fluid chromatography. Progress report, September 1-November 30, 1982, 8:12750 (R:US)
Liquid Column Chromatography
High performance liquid chromatographic group-type analysis of the product of Fischer-Tropsch synthesis. Final report (C_9-C_{14} saturates and unsaturates), 8:12751 (R:US)
ALKANOIC ACIDS
See CARBOXYLIC ACIDS
ALKENES
See also CYCLOALKENES
Liquid Column Chromatography
High performance liquid chromatographic group-type analysis of the product of Fischer-Tropsch synthesis. Final report (C_9-C_{14} saturates and unsaturates), 8:12751 (R:US)
ALKENOIC ACIDS
See CARBOXYLIC ACIDS
ALKYLATES
See ALCOHOLS
ALKYLATING AGENTS
Biological Effects
Measurement of unscheduled synthesis by autoradiography, 8:13132 (BA:US)
ALLOY 800
See INCOLOY 800
ALLOY-HD-8077
See NICKEL BASE ALLOYS
ALLOY-HK-40
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
ALLOY-MA-754
See NICKEL BASE ALLOYS
ALLOY-MA-956
See IRON BASE ALLOYS
ALLOY-RA-333
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
ALLOYS
See also ALUMINIUM ALLOYS
BERYLLIUM ALLOYS
BORON ALLOYS
CHROMIUM ALLOYS
COBALT ALLOYS
GALLIUM ALLOYS
GERMANIUM ALLOYS
IRON ALLOYS
LEAD ALLOYS
LITHIUM ALLOYS
NICKEL ALLOYS
NIOBIUM ALLOYS
RARE EARTH ALLOYS
SILICON ALLOYS
TIN ALLOYS
TITANIUM ALLOYS
VANADIUM ALLOYS
Physical Radiation Effects
Department of Metallurgy and Materials research report, 1981-82, 8:12658 (R:GB)
Research Programs
Department of Metallurgy and Materials research report, 1981-82, 8:12658 (R:GB)
Thermodynamic Properties
Mathematical representation of size and electronic factors, 8:13404 (R:US)
ALLOY-WAZ-16
See NICKEL BASE ALLOYS
ALPHA BEAMS
Energy Losses
Development of a multiwire proportional chamber for nanodosimetry measurement of the energy deposition of alpha particles in smallest sensitive volumina, 8:12964 (R:DE:In German)
ALPHA DETECTION
Nuclear diagnostic for fast alpha particles, 8:13448 (R:US)
Dielectric Track Detectors
Radon and radon-daughter exposure measurements by through-etched track registration in cellulose nitrate, 8:12944 (R:BR)
Studies of alpha particle registration in LR-115 type II. A solid state nuclear track detector, 8:12965 (R:BR)
ALPHA DOSIMETRY
Multiwire Proportional Chambers
Development of a multiwire proportional chamber for nanodosimetry measurement of the energy deposition of alpha particles in smallest sensitive volumina, 8:12964 (R:DE:In German)
ALPHA PARTICLES
Emitted by nuclei.
Dosimetry
Radiation hazards in mining: control, measurement, and medical aspects (Lead abstract), 8:13170 (B:US)
ALPHA REACTIONS
Elastic Scattering
Surface waves in α-nuclei elastic scattering, 8:13303 (R:IT)
Inclusive Interactions
$C(\alpha,X)^{11}C$ cross sections at 1.59 and 4.19 GeV, 8:13313 (J:NL)
ALPHA-BEARING WASTES
Containers
Structural analysis of the TRUPACT contact-handled Transuranic waste transporter, 8:11861 (J:US)
Nondestructive Analysis
Technical plan for the development of an assay system for INEL-stored TRU waste, 8:11933 (R:US)
Waste Transportation
Analysis and model testing of a Super Tiger Type B Waste transport system in accident environments, 8:12863 (J:US)
ALTERNATE FUELS
See FUEL SUBSTITUTION
SYNTHETIC FUELS

ALTERNATORS
Testing
600-watt free-piston Stirling engine generator. Final report, 8:12622 (R:US)
ALUMINIA
See ALUMINIUM OXIDES
ALUMINIUM
Absorption Spectroscopy
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Deformation
Inelastic deformation and phenomenological modeling of aluminum including transient effect, 8:12664 (R:US)
Electrochemistry
Behavior of Al electrodes in aqueous solutions, 8:12813 (R:NO)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Surface Treatments
Characterization of a procedure for preparing 6061 aluminum alloy for barrier anodization, 8:12689 (R:US)
ALUMINIUM 24
Beta-Plus Decay
Isospin mixing in ^{24}Mg, 8:13315 (R:US)
ALUMINIUM 27 TARGET
Electron Reactions
Covariant description of magnetic and electric properties of extended nuclei with half-integral spin in electronscattering, 8:13310 (RA:SU:In Russian)
Proton Reactions
^{27}Al(p,γ)^{28}Si and ^{27}Al(^{3}He,d)^{28}Si to the stretched 11.58-MeV (6^{-},0) and 14.36-MeV (6^{-},1) levels, 8:13316 (R:US)
Restriction of the effective number of independent spin channels in a fluctuation analysis, 8:13317 (RA:SU:In Russian)
ALUMINIUM ALLOYS
See also ALUMINIUM BASE ALLOYS
Chemical Preparation
Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga), 8:12697 (J:US)
Electron Beam Welding
Electron-beam welding of aluminum alloys, 8:12704 (TJ:US)
Hydridation
Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga), 8:12697 (J:US)
Moessbauer Effect
Moessbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces, 8:12675 (R:US)
ALUMINIUM ARSENIDES
Electrical Properties
Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R:US)
Interfaces
Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R:US)
Optical Properties
Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R:US)
Vapor Phase Epitaxy
Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R:US)
ALUMINIUM BASE ALLOYS
Explosive Forming
Microstructural modification of aluminum-silicon alloy powders during dynamic consolidation, 8:12691 (R:US)
ALUMINIUM COMPLEXES
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
ALUMINIUM NITRIDES
Compacting
Explosive consolidation of aluminum nitride ceramic powder: a case history, 8:12716 (R:US)
Explosive Forming
Densification kinetics of shock-activated nitrides, 8:12715 (R:US)
Fracture Properties
Explosive consolidation of aluminum nitride ceramic powder: a case history, 8:12716 (R:US)
Microstructure
Explosive consolidation of aluminum nitride ceramic powder: a case history, 8:12716 (R:US)
ALUMINIUM OXIDES
Activation Energy
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
Catalytic Effects
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
Methanol synthesis, 8:11984 (RA:US)
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
Creep
Characterization and analysis of cavity development during creep of ceramics at elevated temperature. Progress report, 1982 (Lucalox), 8:12709 (R:US)
Ionic Conductivity
NMR in doped monocrystals of superionic conductor β-$LiAlSiO_4$ (β-eukryptite), 8:12698 (J:CH:In German)
Mechanical Properties
Failure of ceramics from multiaxial stresses. Second progress report, November 2, 1981-October 31, 1982, 8:12705 (R:US)
Surface Properties
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R:US)
ALUMINUM
See ALUMINIUM
ALVEOLI (PULMONARY)
See LUNGS
AMBIENT TEMPERATURE
Data Compilation
January 1980 environmental data for sites in the National Solar Data Network, 8:12013 (R:US)
AMERICIUM
Precipitation
Radionuclide sorption on Columbia River basalt interbed materials, 8:13091 (R:US)
Solubility
Radionuclide sorption on Columbia River basalt interbed materials, 8:13091 (R:US)
AMERICIUM 241
Body Burden
1976 Hanford americium exposure incident: organ burden and radiation dose estimates, 8:13148 (R:US)
Chelating Agents
1976 Hanford americium exposure incident: medical management and chelation therapy, 8:13143 (R:US)

Excretion
1976 Hanford americium exposure incident: in vivo measurements, 8:13147 (R:US)
1976 Hanford americium-exposure incident: urinary excretion of trace metals during DTPA treatments, 8:13151 (R:US)
Isotope Ratio
Am-241/Pu-239 + 240 ratios in the marine environment, 8:13094 (J:GB)
Radiation Accidents
1976 Hanford americium-exposure incident: decontamination and treatment facility (Procedures and equipment for handling injured employee), 8:13146 (R:US)
1976 Hanford americium-exposure incident: urinary excretion of trace metals during DTPA treatments, 8:13151 (R:US)
Radioactivity
1976 Hanford americium-exposure incident: external decontamination procedures, 8:13145 (R:US)
Radioecological Concentration
Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R:US)
Sorption
Am-241/Pu-239 + 240 ratios in the marine environment, 8:13094 (J:GB)
Toxicity
1976 Hanford americium exposure incident: overview and perspective, 8:13142 (R:US)
1976 Hanford americium exposure incident: psychological aspects, 8:13144 (R:US)

AMERICIUM COMPLEXES
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)

AMERICIUM COMPOUNDS
Solubility
Thermodynamic properties of chemical species in nuclear waste, 8:12825 (R:US)

AMES LABORATORY
Nondestructive Testing
NDE programs at the Ames Laboratory and Iowa State University, 8:12880 (R:US)

AMES TEST
See MUTAGEN SCREENING

AMIDES
Crystal Structure
Crystal structure of nitromalonamide determined by means of neutron diffraction, 8:12805 (RA:DK:In Danish)
Malonic Acid
Crystal structure of nitromalonamide determined by means of neutron diffraction, 8:12805 (RA:DK:In Danish)

AMINES
See also HYDROXYLAMINE
OXIMES
RHODAMINES
Phosphorescence
Solid-surface luminescence analysis. Progress report, June 1980-October 1982, 8:12804 (R:US)

AMINO ACIDS
Organic acids containing both a basic amino group and an acidic carboxyl group.
See also PROLINE
Biosynthesis
Amino acid synthesis in photosynthesizing spinach cells: effects of ammonia on pool sizes and rates of labeling from $^{14}CO_2$, 8:13122 (J:US)

AMINO ALCOHOLS
See ALCOHOLS
AMINES

AMINO SUGARS
See AMINES

AMINOGLYCIDES
See AMINES

AMMONIA
Biological Effects
Amino acid synthesis in photosynthesizing spinach cells: effects of ammonia on pool sizes and rates of labeling from $^{14}CO_2$, 8:13122 (J:US)
Ion Exchange Chromatography
Applications of ion chromatography, 8:12747 (R:US)

AMMONIUM DIURANATE
See AMMONIUM URANATES

AMMONIUM URANATES
Toxicity
Two-year dose pattern studies of inhaled yellowcake in the Beagle dog, 8:13155 (RA:US)

AMYLUM
See STARCH

ANALOG RESONANCES
See RESONANCE

ANALYSIS (ACTIVATION)
See ACTIVATION ANALYSIS

ANALYSIS (QUANTITATIVE CHEMICAL)
See QUANTITATIVE CHEMICAL ANALYSIS

ANGRA-1 REACTOR
Reactor Start-Up
Insertion of control systems models in the Almod 3 computer code for the simulation of Angra I reactor start-up tests, 8:12301 (R:BR:In Portuguese)

ANGRA-2 REACTOR
Steam Generators
Effect of tube plugging in the thermalhydraulic performance of 'U' tube steam generators, 8:12309 (R:BR:In Portuguese)

ANHARMONIC OSCILLATORS
Hamiltonian Function
Calculations related to quantum stochasticity, an example of overlapping avoided crossings, 8:13412 (J:NL)

ANIMAL CELLS
Includes human cells.
See also TUMOR CELLS
Early Radiation Effects
Flow cytometric quantification of radiation responses of murine peritoneal cells, 8:13152 (R:US)
Morphological Changes
Lumen formation by epithelial cell lines in response to collagen overlay: a morphogenetic model in culture, 8:13119 (J:US)

ANL
Radiation Monitoring
Aerial radiological survey of the Argonne National Laboratory and surrounding area, Argonne, Illinois. Date of survey: May 1977, 8:13064 (R:US)
Research Programs
Physics Division annual review, 1 April 1980-31 March 1981, 8:13293 (R:US)

ANORTHOSITES
Radiothermoluminescence
Thermoluminescence of the mineral components in granite, 8:13216 (R:US)
Thermoluminescence
Thermoluminescence of the mineral components in granite, 8:13216 (R:US)

ANTARES FACILITY
Laser Mirrors
Laser-interferometer position-feedback for precision machine tools, 8:13499 (R:US)
Optical Systems
Laser-interferometer position-feedback for precision machine tools, 8:13499 (R:US)
Reviews
Antares facility for inertial-fusion experiments: status and plans, 8:13485 (R:US)

ANTENNAS
Electromagnetic Fields
Self consistent loop antenna theory, 8:13436 (R:DE)

ANTHRACENE
Fluorescence Spectroscopy
Fluorescence-line-narrowing spectrometry of polycyclic aromatic hydrocarbons in organic glasses, 8:12755 (R:US)

ANTIKNOCK RATINGS
Measuring Methods
Modified cetane scale for low-ignition-quality fuels, 8:11814 (B:US)

ANTIMONY
Activation Analysis
Simultaneous determination of antimony and chlorine in synthetic rubbers by 14 MeV neutron activation analysis, 8:12765 (J:CH)
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
ANTIMONY 122
Energy Levels
Influence of tensor component of effective interaction on the spherical odd-odd nucleus properties, 8:13328 (RA:SU:In Russian)
ANTINEUTRINO-ELECTRON INTERACTIONS
Elastic Scattering
Measurement of nu/sub e/ and anti nu/sub e/ elastic scattering as a test of the standard model, 8:13253 (R:US)
ANTINEUTRINO-PROTON INTERACTIONS
Particle Production
Study of the antivsub(μ)p interactions with a liquid hydrogen sensitive target surrounded with a Ne-H_2 mixture, 8:13261 (R:FR:In French)
ANTIPROTON-NEUTRON INTERACTIONS
Pair Production
Transverse momentum spectra of dimuons produced in hadronic interactions and comparison with QCD, 8:13259 (R:US)
ANTIREFLECTION COATINGS
Stability
Evaluation of solar selective coating stability. Final report, September 1, 1978-May 31, 1980, 8:12178 (R:US)
ANTRIM SHALES
See BLACK SHALES
APPARATUS
See EQUIPMENT
APPLIANCES
See also CLOTHES DRYERS
GAS APPLIANCES
WATER HEATERS
Energy Efficiency Standards
Issues in federal preemption of state appliance energy-efficiency regulations, 8:12565 (R:US)
APPLICATORS (RADIOTHERAPY)
See RADIATION SOURCES
AQUATIC ECOSYSTEMS
Mathematical Models
Larval mortality from offshore mixing as a link between precompetent and competent periods of development, 8:13076 (J:US)
Productivity
Organic energy budget of Rattlesnake Springs, Washington, 8:13075 (J:US)
Respiration
Organic energy budget of Rattlesnake Springs, Washington, 8:13075 (J:US)
Temperature Effects
Foreseeable effects of CO_2-induced climatic change: freshwater concerns, 8:13034 (J:CH)
AQUEOUS HUMOR
See EYES
AQUEOUS SOLUTIONS
Flow Rate
Investigation of the effect of the uranyl ion on proton-spin-relaxation times in aqueous solutions, 8:13007 (R:US)
Spin-Lattice Relaxation
Investigation of the effect of the uranyl ion on proton-spin-relaxation times in aqueous solutions, 8:13007 (R:US)
Spin-Spin Relaxation
Investigation of the effect of the uranyl ion on proton-spin-relaxation times in aqueous solutions, 8:13007 (R:US)
AQUIFERS
Cold Storage
Aquifier thermal energy storage: a survey, 8:12453 (J:US)
Geology
Compressed-air energy storage preliminary design and site-development program in an aquifer. Volume 4. Aquifer geology. Final report, 8:12449 (R:US)
Heat Storage
Aquifier thermal energy storage: a survey, 8:12453 (J:US)
ARAMIDS
Photochemistry
Characterization of Kevlar 49 fibers by electron paramagnetic resonance. Final report, 20 May 1981-20 June 1982 (Radicals induced by ultraviolet or fracture), 8:12726 (R:US)
Stresses
Characterization of Kevlar 49 fibers by electron paramagnetic resonance. Final report, 20 May 1981-20 June 1982 (Radicals induced by ultraviolet or fracture), 8:12726 (R:US)
ARCHITECTURE
Energy Efficiency
Designing for energy efficiency: a study of eight California state office buildings, 8:12560 (R:US)
ARGENTINA
Nuclear Energy
Argentine National Atomic Energy Commission annual report, 1980, 8:13533 (R:AR:SP)
ARGILLITE
Ground Water
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Permeability
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
ARGON
Films
Melting of two-dimensional argon film on graphite. A continuous melting, 8:12736 (RA:DK:In Danish)
ARGONNE NATIONAL LABORATORY
See ANL
ARIZONA
Geochemical Surveys
Hydrogeochemical and stream-sediment reconnaissance basic data for Phoenix quadrangle, Arizona. Uranium Resource Evaluation Project, 8:11830 (R:US)
Geothermal Resources
Geothermal development plan: Maricopa County, 8:12230 (R:US)
Geothermal development plan: Pima County, 8:12231 (R:US)
Geothermal development plan: northern Arizona counties, 8:12232 (R:US)
Geothermal development plan: Pinal County, 8:12233 (R:US)
Geothermal development plan: Graham/Greenlee Counties, 8:12236 (R:US)
Potential of utilization of geothermal energy in Arizona. Executive summary, 8:12185 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Uranium Deposits
Hydrogeochemical and stream-sediment reconnaissance basic data for Phoenix quadrangle, Arizona. Uranium Resource Evaluation Project, 8:11830 (R:US)
ARKANSAS
Coal Deposits
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
AROMATIC ACIDS
See CARBOXYLIC ACIDS
AROMATIC COMPOUNDS
See AROMATICS
AROMATICS
See also BENZENE
CONDENSED AROMATICS
PHENOLS
POLYCYCLIC AROMATIC HYDROCARBONS

Gas Chromatography
Separation of asphaltenes using high-resolution supercritical-fluid chromatography. Progress report, September 1-November 30, 1982 (Heterocyclic aromatic nitrogen compounds), 8:12750 (R:US)
Phosphorescence
Solid-surface luminescence analysis. Progress report, June 1980-October 1982, 8:12804 (R:US)

ARSENIC
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

ASCORBIC ACID
Toxicity
Cytoxicity of vitamin C and metal ions: a site-specific Fenton mechanism. Progress report, July 1981-June 1982, 8:13180 (R:US)

ASDEX TOKAMAK
Plasma Diagnostics
Laser applications, 8:13427 (RA:DE:In German)

ASHES
See also FLY ASH
Chemical Analysis
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Chemical Composition
Analysis of sulfur retention in fluidized-bed combustion, 8:11770 (RA:US)
Design for lignite firing at the San Miguel Power Plant, 8:12272 (RA:US)
Experimental study of heat transfer through coal-ash deposits, 8:11680 (J:US)
Fluidized-bed combustion studies of Texas lignite, 8:11769 (RA:US)
Geochemistry of leachates from selected coal mining and combustion wastes. Project completion report, July 1977-September 1979, 8:11692 (R:US)
Recent research on ash fouling in combustion of low-rank coals, 8:12275 (RA:US)
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals, 8:11725 (RA:US)
Materials Handling
Benefits of coal preparation, 8:11742 (RA:US)
Economics of coal preparation, 8:11743 (RA:US)
Resource Potential
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Thermal Conductivity
Experimental study of heat transfer through coal-ash deposits, 8:11680 (J:US)
Thermodynamic Properties
Thermal and radiative properties of coal-ash deposits. Technical progress report No. 4, September 1-November 30, 1982, 8:11671 (R:US)
Waste Management
Impact of RCRA (PL 94-580) on the use or disposal of solid wastes from Texas lignite-fired utility boilers: a literature survey. Final report, 8:11687 (R:US)

ASTATINE 210
Alpha Decay
Simplified and semisimplified α-decay of N=125 nuclei and effective nucleon-nucleon interaction, 8:13345 (RA:SU:In Russian)

ASTATINE 211
Energy Levels
Effective interaction and structure of odd spherical nuclei, 8:13346 (RA:SU:In Russian)

ATOM COLLISIONS
See also ELECTRON-ATOM COLLISIONS
ION-ATOM COLLISIONS
Coincidence Methods
Multicoincidence techniques in atomic physics, 8:13244 (BA:NL)

ATOMIC BOMBS
See NUCLEAR WEAPONS

ATOMIC ENERGY
See NUCLEAR ENERGY

ATOMIC EXPLOSIONS
See NUCLEAR EXPLOSIONS

ATOMIC PHYSICS
Use only for indexing articles of very broad coverage, such as annual reviews, text books, etc.
Physics of atoms and elementary particles. Semantic collection of scientific papers, 8:13251 (R:SU:RU)
Research Programs
Physics Division annual review, 1 April 1980-31 March 1981, 8:13293 (R:US)

ATOMIC WEAPONS
See NUCLEAR WEAPONS

ATOMICS INTERNATIONAL MOLTEN SALT PROCESS
See MOLTEN SALT COAL GASIFICATION PROCESS

ATTACHED GREENHOUSES
Construction
Sunspaces: design and build an attached solar greenhouse, 8:12163 (R:US)
Design
Sunspaces: design and build an attached solar greenhouse, 8:12163 (R:US)
Thermal Analysis
SLR methods for attached sunspaces, 8:12162 (R:US)

ATTICS
Thermal Insulation
In-situ study of attic loose-fill thermal insulation in residential application, 8:12558 (R:US)

ATTITUDES OF THE PUBLIC
See PUBLIC OPINION

AUGER ELECTRON SPECTROSCOPY
Uses
Use of analytical electron microscopy and auger electron spectroscopy for evaluating materials, 8:12760 (R:US)

AUSTRALIA
Coal Deposits
Developments in the use of low-rank coal in Australia, 8:11723 (RA:US)
Coal Liquefaction
Developments in the use of low-rank coal in Australia, 8:11723 (RA:US)
Coal Reserves
Developments in the use of low-rank coal in Australia, 8:11723 (RA:US)
Eucalyptuses
A computer model of succession and fire response of the high-altitude Eucalyptus forest of the Brindabella Range, Australian Capital Territory, 8:13057 (J:GB)
Power Generation
Developments in the use of low-rank coal in Australia, 8:11723 (RA:US)

AUSTRIA
Radioactivity
Environmental radioactivity in the Austrian section of the river Danube (1975-1979). Natural radioactivity and radiation in Austria. Proceedings of the 5. and 6. annual meeting of the OeSRAD, 8:13087 (R:AT:GE)

AUTOMOBILE EFFICIENCY STANDARDS
See AUTOMOBILES STANDARDS

AUTOMOBILE INDUSTRY
See AUTOMOTIVE INDUSTRY

AUTOMOBILES
Design
Impact of fuel regulations in automotive design and manufacturing, 8:12595 (RA:US)
Efficiency
Impacts of alternative-engine technology on the refining industry, 8:11809 (R:US)
Fuel Economy
Automotive fuel economy - improvement potentials and strategies: manufacturer's viewpoint, 8:12593 (RA:US)

Maintaining automotive mobility: using fuel economy and synthetic fuels to compete with OPEC oil. Final report, 8:12612 (R:US)
Manufacturing
Impact of fuel regulations in automotive design and manufacturing, 8:12595 (RA:US)
Production
Impacts of alternative-engine technology on the refining industry, 8:11809 (R:US)
Propulsion Systems
Analysis and comparison of automotive-propulsion systems, 8:12647 (R:US)
Analysis and comparison of automotive-propulsion systems, 8:12643 (R:US)
Synthetic Fuels
Maintaining automotive mobility: using fuel economy and synthetic fuels to compete with OPEC oil. Final report, 8:12612 (R:US)
Waste Heat
Distilling alcohol with waste automobile heat. Final report, 8:12617 (R:US)
AUTOMOTIVE FUELS
Demonstration Programs
Potential synergisms resulting from the use of methanol in gasoline (Bank of America; methanol-gasoline mixtures), 8:11969 (RA:US)
Energy Demand
Impacts of alternative-engine technology on the refining industry, 8:11809 (R:US)
Performance
Analysis and comparison of automotive-propulsion systems, 8:12643 (R:US)
AUTOMOTIVE INDUSTRY
Marketing
Impact of fuel regulations in automotive design and manufacturing, 8:12595 (RA:US)
Socio-Economic Factors
Impact of fuel regulations in automotive design and manufacturing, 8:12595 (RA:US)
AUXILIARY WATER SYSTEMS
Performance
Evaluation of events involving service water systems in nuclear power plants, 8:12295 (R:US)
AVR REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)
AZIDES
For inorganic compounds only. For organic azides, use AZIDO COMPOUNDS.
Metabolites
Nature and mechanism of induction of mutations. Annual progress report, October 1, 1981-August 1, 1982, 8:13103 (R:US)

B

BACA GEOTHERMAL FIELD
Geothermal Wells
Hydraulic fracture stimulation treatment of Well Baca 23. Geothermal Reservoir Well-Stimulation Program, 8:12242 (R:US)
BACILLUS SUBTILIS
Strand Breaks
Single-strand breaks induced in Bacillus subtilis DNA by ultraviolet light: action spectrum and properties, 8:13163 (J:GB)
BACKFILLING
Demonstration Programs
Returning coal waste underground. Phase I: report addendum, 8:11732 (R:US)
Economics
Returning coal waste underground. Phase I: report addendum, 8:11732 (R:US)
Feasibility Studies
Returning coal waste underground. Phase I: report addendum, 8:11732 (R:US)
Waste Product Utilization
Suction trenching, and the use of fly ash for backfilling, 8:11822 (TJ:GB)
BAGHOUSES
Field Tests
Baghouse performance and ash characterization at the Arapahoe Power Station, 8:12281 (R:US)
Performance
Baghouse performance and ash characterization at the Arapahoe Power Station, 8:12281 (R:US)
BALLASTS
Comparative Evaluations
Integrated-circuit control for two-lamp electronic ballast. Final report, 8:12561 (R:US)
Integrated Circuits
Integrated-circuit control for two-lamp electronic ballast. Final report, 8:12561 (R:US)
BANKS
See COMMERCIAL BUILDINGS
BARGES
Fuel Consumption
Least-energy operation of river shipping, 8:12588 (RA:US)
BARIUM
Absorption Spectroscopy
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Solvent Extraction
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
BARIUM 133
Diffusion
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
BARIUM 138 TARGET
Neutron Reactions
Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R:NL)
BARIUM 139
Decay
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
P States
Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R:NL)
BARIUM 142
Decay
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
BARIUM 146
Decay
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
BARIUM 148
Decay
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
BARIUM COMPOUNDS
Structural Chemical Analysis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)

Synthesis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
BARSTOW SOLAR PILOT PLANT
10-MW solar central receiver pilot plant at Barstow, California.
Central Receivers
Pilot-plant station manual (RADL Item 2-1). Volume III. Equipment data. 10-MWe solar-thermal central-receiver pilot plant: solar-facilities design integration, 8:12121 (R:US)
Computerized Control Systems
Pilot-plant station manual (RADL Item 2-1). Volume III. Equipment data. 10-MWe solar-thermal central-receiver pilot plant: solar-facilities design integration, 8:12121 (R:US)
Data Analysis
10-MWe central-receiver solar-thermal pilot plant data-evaluation plan, 8:12123 (R:US)
Engineering Drawings
10-MWe Solar-Thermal Central-Receiver Pilot Plant: solar-facilities design integration. Integrated (operational) piping and instrumentation diagrams (RADL item 2-38) (Engineering Materials), 8:12127 (E:US)
10-MWe Solar-Thermal Central-Receiver Pilot Plant: solar-facilities design integration. Pilot plant station manual (RADL item 2-1). Volume 2. Drawings (Engineering Materials), 8:12128 (E:US)
Environmental Effects
Environmental effects of solar-thermal power systems: ecological observations during early testing of the Barstow 10-MWe pilot STPS, 8:12125 (R:US)
Wind-flow field measurements in the wake of the Barstow Solar-Thermal Power Plant, 8:12126 (R:US)
Experiment Planning
10-MWe central-receiver solar-thermal pilot plant data-evaluation plan, 8:12123 (R:US)
Heliostats
Heliostat washing equipment requirements (RADL Item 7-17). 10-MWe solar-thermal central-receiver pilot plant: solar facilities design integration, 8:12120 (R:US)
Performance Testing
10-MWe central-receiver solar-thermal pilot plant data-evaluation plan, 8:12123 (R:US)
Pipes
10-MWe Solar-Thermal Central-Receiver Pilot Plant: solar-facilities design integration. Integrated (operational) piping and instrumentation diagrams (RADL item 2-38) (Engineering Materials), 8:12127 (E:US)
Thermal Energy Storage Equipment
Pilot-plant station manual (RADL Item 2-1). Volume III. Equipment data. 10-MWe solar-thermal central-receiver pilot plant: solar-facilities design integration, 8:12121 (R:US)
Towers
Pilot-plant station manual (RADL Item 2-1). Volume III. Equipment data. 10-MWe solar-thermal central-receiver pilot plant: solar-facilities design integration, 8:12121 (R:US)
BARYON NUMBER
Symmetry
Oscillating neutrons and disappearing baryons: a theoretical overview, 8:13275 (R:US)
BASALT
Radionuclide Migration
Solubility equilibria in basalt aquifers: the Columbia Plateau, Eastern Washington, USA, 8:11916 (J:NL)
Waste-Rock Interactions
Release kinetics and alteration of waste glass in crystalline rock systems, 8:11915 (J:NL)
BATTELLE PACIFIC NORTHWEST LABORATORIES
Radiation Accidents
1976 Hanford americium-exposure incident: external decontamination procedures, 8:13145 (R:US)
1976 Hanford americium-exposure incident: decontamination and treatment facility (Procedures and equipment for handling injured employee), 8:13146 (R:US)
Research Programs
Contaminant migration and fate research at Pacific Northwest Laboratory, 8:13045 (R:US)
BATTERIES (ELECTRIC)
See ELECTRIC BATTERIES
BATTERY SEPARATORS
Materials
Development of improved separators for alkaline zinc batteries. Final report, 8:12455 (R:US)
BEAGLES
Body Burden
Two-year dose pattern studies of inhaled yellowcake in the Beagle dog, 8:13155 (RA:US)
Sensitivity
Profile analysis of organic volatiles in urine of tobacco smoke-exposed beagles, 8:13189 (J:NL)
BEAM MONITORS
Design
Beam Intensity Monitor (accelerator drift section) (Engineering Materials), 8:12935 (E:US)
Threshold Detectors
Determination of energetic parameters of the beam of the EhGP-10-P charge-exchange electrostatic accelerator, 8:12928 (R:SU:In Russian)
Energy calibration of the TUNL dual-90° magnet analyzing system, 8:12915 (R:US)
BEARINGS
Monitoring
Vibration monitoring of ebullating pump at the H-Coal pilot plant, 8:11624 (R:US)
BELGIUM
Energy Models
Harmonizatoin of data banks from energy model EFOM 12C with other Belgian data banks. Final report, 8:12461 (R:XE:FR)
BELT PINCH
Plasma Density
HECTOR, a high voltage belt pinch experiment, 8:13426 (RA:DE:In German)
Plasma Diagnostics
HECTOR experiment (high voltage belt pinch), 8:13431 (RA:DE:In German)
Research Programs
Research report 1980, 8:13424 (R:DE:In German)
Research report 1979, 8:13429 (R:DE:In German)
BENZENE
Genetic Effects
Cytogenetic effects of inhaled benzene in murine bone marrow, 8:13188 (BA:US)
Inhalation
Cytogenetic effects of inhaled benzene in murine bone marrow, 8:13188 (BA:US)
Metabolism
Cytogenetic effects of inhaled benzene in murine bone marrow, 8:13188 (BA:US)
Synthesis
Dehydrogenation processes on nickel and platinum surfaces. Conversion of cyclohexane, cyclohexene, and cyclohexadiene to benzene, 8:12810 (J:US)
BENZOPHENONE
Excited States
Triplet excitons in 4,4′-dichlorobenzophenone, 8:12817 (J:US)
Monoclinic Lattices
Triplet excitons in 4,4′-dichlorobenzophenone, 8:12817 (J:US)
BENZOTHIOPHENES
See THIONAPHTHENES
BERYLLIUM
Bioassay
Applications of nuclear technologies for in-vivo elemental analysis, 8:13059 (R:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)
BERYLLIUM 6
Ground States
Detailed investigation of ground state structure of ^{6}Li-^{6}He-^{6}Be nuclei, 8:13307 (RA:SU:In Russian)
BERYLLIUM 7
Beta-Minus Decay
^{7}Be decay scheme and the solar-neutrino problem, 8:13227 (R:US)
BERYLLIUM 7 BEAMS
Beam Production
Radioactive ions beams for studying astrophysical nuclear reactions, 8:12909 (R:US)
BERYLLIUM 9 REACTIONS
Fusion Reactions
Nuclear physics research. Progress report, April 1, 1982-March 31, 1983, 8:13302 (R:US)
BERYLLIUM 9 TARGET
Electron Reactions
Electromagnetic and weak scattering of electrons by the 1p shell nuclei and space parity violation, 8:13311 (RA:SU:In Russian)
BERYLLIUM ALLOYS
Hydrogen Embrittlement
Heat treating effects on environmental hydrogen embrittlement of nickel (Nickel 200, Duranickel 301, Ni—2% Be), 8:12669 (R:US)
Moessbauer Effect
Moessbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces, 8:12675 (R:US)
BERYLLIUM FLUORIDES
Fabrication
Division of Materials Science (DMS) meeting presentation, 8:12742 (R:US)
BERYLLIUM IONS
Ion Sources
Study on laser plasma as a source of multicharged ions for cyclotrons in the light element range (Li,Be,C), 8:12922 (R:SU:In Russian)
BERYLLIUM MODERATORS
See BERYLLIUM
BETA BEAMS (ELECTRONS)
See ELECTRON BEAMS
BETA BEAMS (POSITRONS)
See POSITRON BEAMS
BETA DOSIMETRY
Calibration Standards
Secondary calibration standard for the radiation dose of beta radiation in tissue, 8:13386 (RA:DE:In German)
Dosemeters
Investigations in the field of beta-dosimetry, 8:13385 (RA:DE:In German)
BETA SPECTROSCOPY
Corrections
Calculations of the interference of annihilation radiations with positron spectra in a Ge detector, 8:13000 (J:NL)
BGC-LURGI SLAGGING PROCESS
Commercialization
British Gas slagging gasifier - a springboard into synfuels, 8:11587 (RA:US)
Performance
British Gas slagging gasifier - a springboard into synfuels, 8:11587 (RA:US)
Pilot Plants
British Gas slagging gasifier - a springboard into synfuels, 8:11587 (RA:US)
Thermal Efficiency
British Gas slagging gasifier - a springboard into synfuels, 8:11587 (RA:US)
BIBLIS REACTOR
See BIBLIS-A REACTOR
BIBLIS-A REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)
BICYCLES
Meetings
National conference for bicycle program specialists. Final report, 8:12613 (R:US)
BI-GAS PROCESS
Commercialization
Recent developments in high pressure, entrained flow, slagging gasification of coal update of Bi-Gas Pilot Plant Operations, 8:11589 (RA:US)
Pilot Plants
Recent developments in high pressure, entrained flow, slagging gasification of coal update of Bi-Gas Pilot Plant Operations, 8:11589 (RA:US)
BIKINI
Contamination
Radiation-induced risk of resettling Bikini atoll. Final report, November 7, 1981-May 28, 1982, 8:13140 (R:US)
Radiation Hazards
Radiation-induced risk of resettling Bikini atoll. Final report, November 7, 1981-May 28, 1982, 8:13140 (R:US)
BIOCHEMICAL ACTIVITY
See BIOCHEMISTRY
BIOCHEMISTRY
Meetings
National biochemistry days. Abstracts of papers, 8:13104 (R:CS:CZ)
BIOCONVERSION
Environmental Impacts
Biomass energy systems: status of environmental, health and safety investigations, 8:12047 (R:US)
BIOLOGICAL EVOLUTION
Mathematical Models
Model of naticid gastropod predator-prey coevolution, 8:13073 (R:US)
BIOLOGICAL MATERIALS
Biological Radiation Effects
Nature of oxygen-containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, July 1981-June 1982, 8:12820 (R:US)
BIOLOGICAL REPAIR
Inhibition
Differential responses of log and stationary phase human fibroblasts to inhibition of DNA repair by aphidicolin, 8:13161 (J:NL)
BIOMASS
Comminution
Preparation of biomass for gasification, 8:12089 (RA:US)
Compacting
Preparation of biomass for gasification, 8:12089 (RA:US)
Conversion
Feasibility study for early commercialization of a modular-unit dual fluidized-bed system for converting terrestrial biomass into alternate fuels, 8:12084 (RA:US)
Economics
Unconventional plants for biomass feedstocks in semi-arid West Texas. Final report, 8:12101 (R:US)
Energy Models
Technology assessment of solar energy systems. Scenario development and methodology. Volume II, 8:12019 (R:US)
Gasification
Biomass gasification developments, 8:11990 (RA:US)
Biomass-to-methanol specialists' workshop, 8:11983 (R:US)
Development of biomass gasification to produce substitute fuels, 8:12072 (RA:US)
Feeding coal and biomass into high pressure reactors, 8:12090 (RA:US)
Preparation of biomass for gasification, 8:12089 (RA:US)
Steam gasification of biomass, 8:12070 (RA:US)
Technical and economic assessment of liquid-fuel production from biomass, 8:12074 (RA:US)
Thagard high-temperature fluid-wall reactor for syngas generation from biomass, 8:12091 (RA:US)
Heating
Development of an indirectly heated pyrolysis reactor, 8:11964 (RA:US)

Liquefaction
Bench scale research in biomass direct liquefaction, 8:12082 (RA:US)
Examination of alternative catalysts for biomass direct liquefaction, 8:12083 (RA:US)
Materials Handling Equipment
Preparation of biomass for gasification, 8:12089 (RA:US)
Meetings
Proceedings of the 14th biomass thermochemical conversion contractor's meeting, 8:12068 (R:US)
National Program Plans
Impact of biomass-derived energy programs, 8:12034 (RA:BR)
Pyrolysis
Fundamental pyrolysis studies, 8:12076 (RA:US)
Research Programs
Texas Energy Development Fund. Project status reports, 8:11998 (R:US)
Technology Assessment
Technological aspects of solar energy utilization, 8:12107 (RA:CH)
Technology assessment of solar energy systems. Scenario development and methodology. Volume II, 8:12019 (R:US)
Thermochemical Processes
Proceedings of the 14th biomass thermochemical conversion contractor's meeting, 8:12068 (R:US)
Uses
Technological aspects of solar energy utilization, 8:12107 (RA:CH)

BIOMASS CONVERSION PLANTS
Use only for plants converting biomass to fuel, do NOT use for plants preparing wastes and biomass for combustion.
By-Products
Methanol production from fermentor off-gases. Final report, July 1, 1981-June 30, 1982 (CDH-methanol process), 8:11972 (R:US)
Cost
Report on the engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc. at Thibodaux, Louisiana. Attachment B, Volume III. Definitive estimate. Section 1: terminal, 8:12016 (R:US)
Economic Analysis
Report on the engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc., at Thibodaux, Louisiana, 8:12054 (R:US)
Feasibility Studies
Feasibility study for early commercialization of a modular-unit dual fluidized-bed system for converting terrestrial biomass into alternate fuels, 8:12084 (RA:US)
Report on the engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc., at Thibodaux, Louisiana, 8:12054 (R:US)
Fluidized Bed
Feasibility study for early commercialization of a modular-unit dual fluidized-bed system for converting terrestrial biomass into alternate fuels, 8:12084 (RA:US)
Storage Facilities
Report on the engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc. at Thibodaux, Louisiana. Attachment B, Volume III. Definitive estimate. Section 1: terminal, 8:12016 (R:US)

BIOMASS PLANTATIONS
Aquaculture
Emergent aquatics: stand establishment, management, and species screening, 8:12095 (R:US)
Cultivation Techniques
Emergent aquatics: stand establishment, management, and species screening, 8:12095 (R:US)
Environmental Impacts
Alcohols from biomass: state-of-knowledge survey of environmental, health and safety aspects, 8:12045 (R:US)
Biomass energy systems: status of environmental, health and safety investigations, 8:12047 (R:US)

BIRDS
Habitat
Florida atlas of breeding sites for herons and their allies: 1976-1978, 8:13055 (R:US)
Population Density
Bird communities and vegetation structure in pine plantations of the southeastern Coastal Plain, 8:13052 (R:US)
Species Diversity
Bird communities and vegetation structure in pine plantations of the southeastern Coastal Plain, 8:13052 (R:US)

BISMUTH
Activation Analysis
Activation of Tl, Pb and Bi by 10-160 MeV neutrons: possible application to the analysis of Bi, 8:12769 (J:CH)
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

BISMUTH 207
Energy Levels
Effective interaction and structure of odd spherical nuclei, 8:13346 (RA:SU:In Russian)

BISMUTH 211
Energy Levels
Effective interaction and structure of odd spherical nuclei, 8:13346 (RA:SU:In Russian)

BISMUTH COMPOUNDS
See also BISMUTH TUNGSTATES
Electrical Properties
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
Grain Orientation
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)

BISMUTH TUNGSTATES
Electrical Properties
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
Grain Orientation
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)

BITUMINOUS COAL
Devolatilization
Time-resolved weight loss kinetics for the rapid devolatilization of a bituminous coal, 8:11657 (RA:US)
Weight Measurement
Time-resolved weight loss kinetics for the rapid devolatilization of a bituminous coal, 8:11657 (RA:US)

BLACK SHALES
Bulk Density
Study of hydrocarbon: shale interaction. Progress report 315, July 1-September 30, 1979, 8:11824 (R:US)
Permeability
Study of hydrocarbon: shale interaction. Progress report 315, July 1-September 30, 1979, 8:11824 (R:US)
Porosity
Study of hydrocarbon: shale interaction. Progress report 315, July 1-September 30, 1979, 8:11824 (R:US)
Resource Assessment
Study of hydrocarbon: shale interaction. Progress report 315, July 1-September 30, 1979, 8:11824 (R:US)
Retorting
Synthetic fuels from US oil shales: a technical and economic verification of the HYTORT process. Final report (incorporates fourth quarterly report), January 1-March 31, 1981, 8:11825 (R:US)
Stratigraphy
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)

BLANKETS (BREEDING)
See BREEDING BLANKETS

BLASTING
See EXPLOSIVE FRACTURING
BLOOD CHEMISTRY
Biological Radiation Effects
1976 Hanford Americium exposure incident: hematologic effects, 8:13149 (R:US)
BLOOD CLOTTING
See BLOOD COAGULATION
BLOOD COAGULATION
Biological Radiation Effects
Effects of monomeric ^{239}Pu on the pregnant rabbit (Blood clotting), 8:13167 (J:GB)
BLOWDOWN
Pressure Gradients
First comparison of the results of standard problems carried out in the blowdown region (PWR), 8:12397 (R:DE:GE)
Recycling
Waste-heat vertical tube foam evaporation for cooling tower blowdown renovation/recycle. Project summary report, 8:12277 (R:US)
Temperature Gradients
First comparison of the results of standard problems carried out in the blowdown region (PWR), 8:12397 (R:DE:GE)
Two-Phase Flow
Phase separation. Final report, 8:12383 (R:DE:GE)
BLOWERS
Acoustic Monitoring
Discrete frequency noise and its reduction in small axial-flow fans. Technical memo, 8:12836 (R:US)
BNL
Computer Networks
Introduction to the Central Scientific Computing Facilities, 8:13539 (R:US)
BOILER FUEL
See BOILER FUELS
BOILER FUELS
Constraints
Regulatory constraints on industrial coal utilization (Constraints to coal use: low cost of gas, capital cost of coal boilers, clean air, etc.), 8:11764 (RA:US)
Fuel Substitution
Conversion of an industrial boiler to Coal-Oil Mixture, 8:11761 (RA:US)
Industrial coal utilization: fourth annual symposium, 8:11780 (R:US)
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Legislation
Regulatory constraints on industrial coal utilization (Constraints to coal use: low cost of gas, capital cost of coal boilers, clean air, etc.), 8:11764 (RA:US)
Regulations
Regulatory constraints on industrial coal utilization (Constraints to coal use: low cost of gas, capital cost of coal boilers, clean air, etc.), 8:11764 (RA:US)
BOILERS
See also REFUSE-FUELED BOILERS
Air Pollution Abatement
Application of dry additives on reducing SO_2 emission for brown coal-fired boilers, 8:12283 (RA:US)
Air Pollution Control
Bubbles, existing and new under the Clean Air Act (Compliance based on total plant emission rather than limits on each boiler), 8:13051 (RA:US)
Availability
Benefits of coal preparation, 8:11742 (RA:US)
Economics of coal preparation, 8:11743 (RA:US)
Design
Design for lignite firing at the San Miguel Power Plant, 8:12272 (RA:US)
Efficiency
Benefits of coal preparation, 8:11742 (RA:US)
Economics of coal preparation, 8:11743 (RA:US)
Fouling
Design for lignite firing at the San Miguel Power Plant, 8:12272 (RA:US)
Recent research on ash fouling in combustion of low-rank coals, 8:12275 (RA:US)
Gaseous Wastes
Boiler efficiency and emissions testing using refuse-derived fuel (RDF) and coal, Wright-Patterson Air Force Base, Ohio 45433. Final report 21-26 Feb 82, 8:12892 (R:US)
Outages
Recent research on ash fouling in combustion of low-rank coals, 8:12275 (RA:US)
Performance
Boiler efficiency and emissions testing using refuse-derived fuel (RDF) and coal, Wright-Patterson Air Force Base, Ohio 45433. Final report 21-26 Feb 82, 8:12892 (R:US)
Design for lignite firing at the San Miguel Power Plant, 8:12272 (RA:US)
BOILING WATER COOLED AND MODERATED REACTO
See BWR TYPE REACTORS
BONES
See SKELETON
BONNEVILLE POWER ADMINISTRATION
Regional Cooperation
Bonneville Power Administration and Rural Electrification Administration actions and activities affecting utility participation in Washington Public Power Supply System Plants 4 and 5, 8:12506 (R:US)
BOOSTERS (PARTICLE)
See PARTICLE BOOSTERS
BORIDES
See also COBALT BORIDES
ERBIUM BORIDES
IRON BORIDES
RHODIUM BORIDES
RUTHENIUM BORIDES
YTTRIUM BORIDES
Magnetic Properties
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)
Superconductivity
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)
BORON
Chemical Analysis
Applications of ion chromatography, 8:12747 (R:US)
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)
BORON 10 REACTIONS
Breakup Reactions
Nuclear physics research. Progress report, April 1, 1982-March 31, 1983, 8:13302 (R:US)
BORON 11 REACTIONS
Breakup Reactions
Nuclear physics research. Progress report, April 1, 1982-March 31, 1983, 8:13302 (R:US)
BORON 11 TARGET
Electron Reactions
Covariant description of magnetic and electric properties of extended nuclei with half-integral spin in electronscattering, 8:13310 (RA:SU:In Russian)
Proton Reactions
Neutron yields from the 4-12 MeV proton bombardment of ^{11}B, ^{13}C and ^{18}O as related to the production of ^{11}C, ^{13}N and ^{18}f, 8:13314 (J:GB)

BORON ALLOYS
Mossebauer Effect
Mossbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces, 8:12675 (R:US)
Relaxation Time
Direct spectrum-analysis method for obtaining the relaxation-time spectrum from relaxation-response data: amorphous metals ($Fe_{80}Ni_{68}P_{14}B_6$), 8:12684 (R:US)
BORON COMPOUNDS
See also BORIDES
Fabrication
Neutron-shielding material. Translated from the Japanese, 8:13374 (R:US)
BOROSILICATE GLASS
Corrosion Resistance
Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance, 8:11867 (R:US)
Leachates
Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance, 8:11867 (R:US)
Leaching
Characterization of borosilicate glass containing Savannah River Plant radioactive waste, 8:11878 (R:US)
BOROSILICATES
See BOROSILICATE GLASS
BOUND STATE
Wave Functions
Convergence of reflectionless approximations to confining potentials, 8:13411 (J:US)
BOUNDARIES (GRAIN)
See GRAIN BOUNDARIES
BOUNDARY LAYERS
Turbulence
MONEX79 atmospheric boundary-layer experiment over the Bay of Bengal: Digha data report, 8:13019 (R:US)
BPA
See BONNEVILLE POWER ADMINISTRATION
BRACKISH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS
BRAZIL
Alcohol Fuels
Dimensioning the role of alcohol fuels in Brazil's energy future, 8:12480 (RA:BR)
Energy Consumption
Brazilian biomass utilization program, with emphasis on proalcool, 8:12025 (RA:BR)
Energy issues and policies in Brazil, 8:12489 (R:BR)
Energy Policy
Energy issues and policies in Brazil, 8:12489 (R:BR)
Energy Supplies
Environmental impacts of energy utilization, 8:12468 (R:BR:In Portuguese)
Methanol Fuels
Outlook for methanol in Brazil, 8:12510 (RA:US)
National Program Plans
Impact of biomass-derived energy programs, 8:12034 (RA:BR)
Outlook for methanol in Brazil, 8:12510 (RA:US)
Petroleum Refineries
Oil refining flexibility and alternative fuels, 8:11807 (RA:BR)
BREEDER REACTORS
See also FBR TYPE REACTORS
Thorium Cycle
JFS libraries and the effect of beryllium on the breeding, 8:12313 (R:BR:In Portuguese)
BREEDING BLANKETS
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
Design
A high-temperature fusion blanket for synfuel and electrical production, 8:13519 (J:US)
Thermal-hydraulics design considerations for the STARFIRE-DEMO breeding blanket, 8:13516 (J:US)
Neutronic Damage Functions
Tritium-tritium fusion: blanket neutronics and photonics, 8:13513 (J:US)
Photonuclear Reactions
Tritium-tritium fusion: blanket neutronics and photonics, 8:13513 (J:US)
Radioactivation
Systematic investigtion of material activation on the TFTR, 8:13511 (J:US)
Tritium Recovery
Tritium control for the DEMO liquid-metal blanket design, 8:13517 (J:US)
BREMSSTRAHLUNG (MAGNETIC)
See SYNCHROTRON RADIATION
BRILLOUIN EFFECT
Numerical Solution
Numerical study of phase conjugation in stimulated Brillouin scattering from an optical waveguide, 8:13488 (R:US)
BRILLOUIN SCATTERING
See BRILLOUIN EFFECT
BRINES
Partition
Development of a rapid and accurate method for determining partition coefficients of chemical tracers between oils and brines (for single well tracer tests). Final report, 8:11796 (R:US)
Reinjection
Prediction of chemical problems in the reinjection of geothermal brines, 8:12238 (J:US)
Scale Control
Treatment methods for geothermal brines, 8:12252 (J:US)
BROMINATED ALICYCLIC HYDROCARBONS
Molecular Structure
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R:US)
Monoclinic Lattices
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R:US)
BROMINATED ALIPHATIC HYDROCARBONS
Fragmentation
Fragmentation mechanism and energetics of some alkyl halide ions, 8:12809 (J:US)
Threshold Energy
Fragmentation mechanism and energetics of some alkyl halide ions, 8:12809 (J:US)
BROMINE
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
BROMINE 82
Radiopharmaceuticals
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)
Tissue Distribution
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)
BROMINE BROMIDES
See BROMINE
BRONCHOGENIC CARCINOMA
See CARCINOMAS
RESPIRATORY SYSTEM DISEASES
BROOKHAVEN 200-MEV LINAC
Isotope Production
Production of spallation radionuclides for medical applications at BLIP, 8:12912 (R:US)
BROOKHAVEN AGS
Polarized Beams
Workshop on acceleration of polarized protons: summary report, 8:12899 (R:US)
BROOKHAVEN NATIONAL LABORATORY
See BNL
BROWN COAL
See also LIGNITE

Combustion
Application of dry additives on reducing SO_2 emission for brown coal-fired boilers, 8:12283 (RA:US)
Hydrogenation
Synthetic fuels industry in Germany 1927 to 1945, 8:11778 (RA:US)
Meetings
Technology and use of lignite, 8:11718 (R:US)
Production
Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA:US)
Research Programs
Technology and use of lignite, 8:11718 (R:US)

BROWNS FERRY-3 REACTOR
Reactor Cores
Neutronics analysis of Browns Ferry 3 partial control rod insertion, 8:12425 (J:US)
Reactor Kinetics
Neutronics analysis of Browns Ferry 3 partial control rod insertion, 8:12425 (J:US)

BUBBLES
Heat Transfer
Heat, mass, and momentum transfer from large two-phase bubbles (UVABUBL), 8:12320 (D:US)
Mass Transfer
Heat, mass, and momentum transfer from large two-phase bubbles (UVABUBL), 8:12320 (D:US)
Two-Phase Flow
Heat, mass, and momentum transfer from large two-phase bubbles (UVABUBL), 8:12320 (D:US)

BUCKET WHEEL EXCAVATORS
Status of Gulf Coast lignite activity, 8:11721 (RA:US)

BUILDING (CONSTRUCTING)
See CONSTRUCTION

BUILDINGS
See also COMMERCIAL BUILDINGS
GREENHOUSES
HOSPITALS
OFFICE BUILDINGS
PREFABRICATED BUILDINGS
PUBLIC BUILDINGS
RESIDENTIAL BUILDINGS
SCHOOL BUILDINGS
Construction
Los Alamos National Laboratory building cost index, 8:12850 (R:US)
Cost
Los Alamos National Laboratory building cost index, 8:12850 (R:US)
Energy Conservation
Using weather forecasts for a more efficient use of heating systems, 8:12554 (RA:CH)
Energy Demand
Climate, energy demands and energy consumption with special regard to human settlements, 8:12553 (RA:CH)
Energy Management Systems
Controlling energy consumption in single buildings. Final report for period ending May 82, 8:12551 (R:US)
Meteorology
Solar and wind energy research in connexion to community and building planning, 8:12010 (RA:CH)
Seismic Effects
Damping in building structured during earthquakes: test data and modeling, 8:12854 (R:US)
Temperature Control
Survey of the international development in indoor climate control, 8:12564 (R:US)

BUILDINGS (CONTAINMENT)
See CONTAINMENT BUILDINGS

BUNDLE DIVERTORS
Nozzles
Supersonic gas target for a bundle divertor plasma, 8:13504 (J:AT)
Supersonic Flow
Supersonic gas target for a bundle divertor plasma, 8:13504 (J:AT)

BUNDLES (FUEL ELEMENTS)
See FUEL ELEMENT CLUSTERS

BUNKER OILS
See RESIDUAL FUELS

BUNKERS
See HOPPERS

BURNABLE POISONS
Comparative Evaluations
Analytical comparison of Boron and cadmium absorbers in research reactors, 8:12374 (J:US)

BURNER FUEL OIL
See HEATING OILS

BURSA OF FABRICIUS
See BIRDS

BUSES
Fuel Economy
America's overlooked energy resource: the intercity bus, 8:12601 (RA:US)
Government Policies
America's overlooked energy resource: the intercity bus, 8:12601 (RA:US)

BWR TYPE REACTORS
See also BROWNS FERRY-3 REACTOR
KUOSHENG-1 REACTOR
KUOSHENG-2 REACTOR
LINGEN REACTOR
OYSTER CREEK-1 REACTOR
RWE-BAYERNWERK REACTOR
VAK REACTOR
WNP-2 REACTOR
WUERGASSEN REACTOR
Alarm Systems
Technical note: handling of alarms using logic, 8:12362 (J:US)
Auxiliary Water Systems
Evaluation of events involving service water systems in nuclear power plants, 8:12295 (R:US)
Containment Buildings
BWR 4/Mark I accident sequences assessment, 8:12415 (R:US)
Hydrogen production during fragmented debris/concrete interactions, 8:12419 (R:US)
Economics
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Fuel Element Clusters
Experimental investigation of the enthalpy- and mass flow-distribution in 16-rod clusters with BWR-PWR-geometries and conditions. Final report of the ISPRA test-series with the complete data set, 8:12290 (R:XE)
Fuel Rods
Fuel-rod vibration in two-phase flow, 8:12291 (R:US)
Legal Aspects
Unresolved safety issues summary: aqua book, 8:12405 (R:US)
Loss of Coolant
Fluid-structure-coupling algorithm, 8:12420 (R:US)
LOCA simulation in NRU program. Data report for thermal-hydraulic experiment 2 (TH-2), 8:12411 (R:US)
Recent advances in evaluation of BWR loss-of-coolant accident, 8:12424 (J:US)
Meltdown
Assessment of fuel-foaming potential during core-meltdown accidents, 8:12414 (R:US)
Hydrogen production during fragmented debris/concrete interactions, 8:12419 (R:US)
Pressure Suppression
Suppression-pool temperature limits for BWR containments, 8:12406 (R:US)
Pressure Vessels
Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982, 8:12294 (R:US)
Pumps
Flow-induced vibration characteristics of the BWR/5-201 jet pump, 8:12292 (R:US)
Reactivity Coefficients
Importance of spatial kinetics in LWR safety analysis, 8:12444 (J:US)
Reactor Accidents
Accident Sequence Evaluation Program, 8:12388 (R:US)
BWR 4/Mark I accident sequences assessment, 8:12415 (R:US)
Comprehensive (MORT based) approach to planning internal decontamination, 8:12418 (R:US)

Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents, 8:12413 (R:US)
Reactor Components
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)
Reactor Control Systems
Technical note: handling of alarms using logic, 8:12362 (J:US)
Reactor Decommissioning
Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents, 8:12413 (R:US)
Reactor Noise
Third Specialists Meeting on Reactor Noise, 8:12344 (J:US)
Reactor Operation
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)
Operating US power reactors, 8:12297 (J:US)
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Reactor Safety
Unresolved safety issues summary: aqua book, 8:12405 (R:US)
Reactor Shutdown
Events resulting in reactor shutdown and their causes, 8:12426 (J:US)

C

CABLES (ELECTRIC)
See ELECTRIC CABLES
CADMIUM
Bioassay
Applications of nuclear technologies for in-vivo elemental analysis, 8:13059 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
CADMIUM 112
Biological Effects
Inducible cadmium binding complexes of cabbage and tobacco, 8:13111 (J:US)
CADMIUM 117
Energy-Level Density
Parameter of nuclear level density spin dependence in the range A approximately 100, 8:13332 (RA:SU:In Russian)
CADMIUM COMPLEXES
Chemical Activation
Inducible cadmium binding complexes of cabbage and tobacco, 8:13111 (J:US)
CADMIUM SELENIDES
Stabilization
Electrochemical photovoltaic cells/stabilization and optimization of II-VI semiconductors. Third technical progress report, 1 October-31 December 1979, 8:12093 (R:US)
CADMIUM SULFIDES
Stabilization
Electrochemical photovoltaic cells/stabilization and optimization of II-VI semiconductors. Third technical progress report, 1 October-31 December 1979, 8:12093 (R:US)
CADMIUM TELLURIDES
Stabilization
Electrochemical photovoltaic cells/stabilization and optimization of II-VI semiconductors. Third technical progress report, 1 October-31 December 1979, 8:12093 (R:US)
CAES
See COMPRESSED AIR ENERGY STORAGE
CAES PLANT
See COMPRESSED AIR STORAGE POWER PLANTS
CALCINED WASTES
Leaching
Pelletized waste form demonstration program, April-September 1982, 8:11890 (R:US)
Pelletizing
Pelletized waste form demonstration program, April-September 1982, 8:11890 (R:US)
CALCITE
Solubility
Carbonate equilibria in hydrothermal systems: first ionization of carbonic acid in NaCl media to 300°C, 8:12254 (J:GB)
CALCIUM
Absorption Spectroscopy
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Solvent Extraction
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
CALCIUM 40
Alpha Reactions
Surface waves in α-nuclei elastic scattering, 8:13303 (R:IT)
Nuclear Radii
Surface waves in α-nuclei elastic scattering, 8:13303 (R:IT)
CALCIUM BROMIDES
Crystal Structure
Investigations on the structure and polymorphy of the dibromides of dysprosium, thulium, ytterbium and calcium, 8:12781 (R:DE:In German)
CALCIUM CHLORIDES
Chemical Reactions
Sulfonate precipitation-redissolution-reprecipitation in inorganic electrolytes, 8:12801 (J:US)
Precipitation
Sulfonate precipitation-redissolution-reprecipitation in inorganic electrolytes, 8:12801 (J:US)
CALCIUM COMPLEXES
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
CALCIUM OXIDES
Crystal Doping
Incorporation of atomic carbon and hydrogen in high-melting oxide - nuclear-chemical, dilatometric and infrared spectroscopical investigations on C- and H-doped MgO and CaO-monocrystals, 8:12710 (R:DE:In German)
CALCIUM SULFATES
Chemical Reaction Kinetics
Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen, 8:12787 (R:US)
Decomposition
Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen, 8:12787 (R:US)
Pelletizing
Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen, 8:12787 (R:US)
Reduction
Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen, 8:12787 (R:US)
CALCULATIONS (MANY DIMENSIONS)
See MANY-DIMENSIONAL CALCULATIONS

CALCULATORS
Programming
System for developing HP41CV hand-held calculator programs on an HP9845 desktop computer, 8:13561 (R:US)
CALIBRATION STANDARDS
Activation Analysis
Analysis of standard reference materials by absolute INAA, 8:12768 (J:CH)
CALIFORNIA
See also COSO HOT SPRINGS
LONG VALLEY
Baseline Ecology
Ecological characterization of the central and northern California coastal region. Volume IV. Watersheds and basins. Chapters 1-16, 8:13070 (R:US)
Ecological characterization of the central and northern California coastal region. Volume III, Part 2. Community composition lists, 8:13069 (R:US)
Ecological characterization of the central and northern California coastal regtion. Volume II, Part 1. Regional characterization, 8:13068 (R:US)
Ecological characterization of the central and northern Californa coastal region. Volume IV. Watersheds and basins. Chapters 17-29, 8:13071 (R:US)
Coastal Regions
Ecological characterization of the central and northern California coastal region. Volume III, Part 1. Habitats, 8:13054 (R:US)
Ecological characterization of the central and northern California coastal region. Volume II, Part 2. Species, 8:13053 (R:US)
Coastal Waters
Ecological characterization of the central and northern California coastal region. Volume III, Part 1. Habitats, 8:13054 (R:US)
Ecological characterization of the central and northern California coastal region. Volume II, Part 2. Species, 8:13053 (R:US)
Energy Policy
Impact of energy pricing upon the Hispanic community, 8:12464 (R:US)
Fishes
Distribution and abundance patterns of rocky intertidal fishes in central California, 8:13077 (J:NL)
Geochemical Surveys
Chemical composition of water and gas from five nearshore subaqueous springs in Clear Lake, 8:12213 (RA:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for San Luis Obispo and Santa Cruz Quadrangles, California, 8:11831 (R:US)
Mercury in the sediments of Clear Lake, 8:12214 (RA:US)
Strontium isotopes in the Clear Lake Volcanics, 8:12191 (RA:US)
Geology
Strontium isotopes in the Clear Lake Volcanics, 8:12191 (RA:US)
Gravity Surveys
Detailed gravity survey of the Wilbur Springs area, California, 8:12207 (RA:US)
Habitat
Ecological characterization of the central and northern California coastal region. Volume III, Part 1. Habitats, 8:13054 (R:US)
Hot Springs
Detailed gravity survey of the Wilbur Springs area, California, 8:12207 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Paleontology
Pliocene and Pleistocene fishes from the Clear Lake area, 8:12195 (RA:US)
Plants
Ecological characterization of the central and northern California coastal region. Volume II, Part 2. Species, 8:13053 (R:US)
Resource Assessment
Energy resources in California, 8:12483 (R:US)
Seismic Surveys
Seismic-refraction measurements of crustal structure near Santa Rosa and Ukiah, California, 8:12208 (RA:US)
Species Diversity
Ecological characterization of the central and northern California coastal region. Volume III, Part 2. Community composition lists, 8:13069 (R:US)
Stratigraphy
Late Pleistocene stratigraphy and palynology of Clear Lake, 8:12194 (RA:US)
Uranium Deposits
Hydrogeochemical and stream-sediment reconnaissance basic data for Fresno and Death Valley quadrangles, California; Nevada. Uranium Resource Evaluation Project, 8:11832 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for San Luis Obispo and Santa Cruz Quadrangles, California, 8:11831 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Volcanic Regions
Geochronology and evolution of the Clear Lake Volcanics, 8:12190 (RA:US)
Paleomagnetism of the Clear Lake Volcanics and new limits on the age of the Jaramillo normal-polarity event, 8:12192 (RA:US)
Well Drilling
Resumption of exploratory drilling operations by Texaco, Inc.: state oil and gas leases - PRC 2725.1 (Jade Prospect), PRC 2206.1 (Anita Prospect), PRC 2955.1 (Refugio Prospect), Santa Barbara County. Final environmental impact report, 8:13101 (R:US)
Wild Animals
Ecological characterization of the central and northern California coastal region. Volume II, Part 2. Species, 8:13053 (R:US)
CALIFORNIUM
Solution Heat
Physical-chemical studies of transuranium elements. Progress report, April 1, 1982-March 31, 1983, 8:12775 (R:US)
CALIFORNIUM 252
Neutron Dosimetry
Use of a D_2O moderated Cf-252 source for dosimeter testing and calibrating, 8:13396 (RA:US)
Neutron Spectra
Calibration of neutron dosimetry techniques for use in reactor buildings, 8:12991 (RA:US)
Spectral and dosimetric characteristics of a moderated-neutron calibration facility, 8:13399 (RA:US)
CALORIMETERS (PARTICLE)
See SHOWER COUNTERS
CAMAC SYSTEM
Computer Application to Measurement And Control.
Specifications
SLAC Camac Crate Controller Model 3 (Engineering Materials), 8:13003 (E:US)
CANADA
See also ONTARIO
Coal Deposits
Canadian low-rank coals: resources, conversion and utilization, 8:11722 (RA:US)
Coal Reserves
Canadian low-rank coals: resources, conversion and utilization, 8:11722 (RA:US)
Energy Policy
Peat for energy and chemicals research and development program of NRC, 8:11700 (RA:US)
Nuclear Power Plants
Comparison of Ontario Hydro's performance with world power reactors, 1981, 8:12475 (R:CA)
Methodology for the inspection of items important to safety. The Canadian approach, 8:12399 (R:CA)

Reactor Licensing
Licensing and safety of nuclear power plants in Canada, 8:12325 (R:CA)
Reactor Sites
Role of regulatory body related to siting, 8:12365 (R:CA)
Seismic Arrays
Canadian seismic agreement. Annual report, 1 July 1981 to 30 June 1982, 8:13210 (R:US)
Seismicity
Canadian seismic agreement. Annual report, 1 July 1981 to 30 June 1982, 8:13210 (R:US)

CANADIAN AECB
Canadian Atomic Energy Control Board.
Nuclear Power Plants
Methodology for the inspection of items important to safety. The Canadian approach, 8:12399 (R:CA)

CANCER
See NEOPLASMS

CANONICAL EQUATIONS
See DIFFERENTIAL EQUATIONS

CAPACITORS
Breakdown
Parametric investigations and other related studies of energy storage type capacitors. Quarterly report, 8:12451 (R:US)
Fabrication
Parametric investigations and other related studies of energy storage type capacitors. Quarterly report, 8:12451 (R:US)

CAPSULES
Welded Joints
Surface studies of iridium-alloy grain boundaries associated with weld cracking, 8:11949 (R:US)

CARBINOL
See METHANOL

CARBOHYDRATES
Fermentation
Non-enzymatic hydrolysis of carbohydrates, 8:12028 (RA:BR)
Hydrolysis
Non-enzymatic hydrolysis of carbohydrates, 8:12028 (RA:BR)

CARBON
See also GRAPHITE
Elutriation
Carbon attrition during the fluidized combustion and gasification of coal. Quarterly technical progress report, 1 June 1982-31 August 1982, 8:11767 (R:US)
Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)

CARBON 12 REACTIONS
Elastic Scattering
Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R:US)
Inclusive Interactions
HISS spectrometer at the Bevalac, 8:13265 (R:US)
One-Nucleon Transfer Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)

CARBON 12 TARGET
Alpha Reactions
$C(\alpha,X)^{11}C$ cross sections at 1.59 and 4.19 GeV, 8:13313 (J:NL)
Boron 11 Reactions
Nuclear physics research. Progress report, April 1, 1982-March 31, 1983, 8:13302 (R:US)
Carbon 12 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
HISS spectrometer at the Bevalac, 8:13265 (R:US)
Neon 20 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Oxygen 16 Reactions
Three-particle decay of the 14^+ resonance with 19.7 MeV energy excited in the $^{16}O+^{12}C$ reaction, 8:13309 (RA:SU:In Russian)
Proton Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)

CARBON 13 TARGET
Boron 10 Reactions
Nuclear physics research. Progress report, April 1, 1982-March 31, 1983, 8:13302 (R:US)
Proton Reactions
Neutron yields from the 4-12 MeV proton bombardment of ^{11}B, ^{13}C and ^{18}O as related to the production of ^{11}C, ^{13}N and ^{18}f, 8:13314 (J:GB)

CARBON 14 TARGET
Proton Reactions
Charge-exchange 1^+ excitations and precritical phenomena in the atomic nuclei, 8:13304 (RA:SU:In Russian)

CARBON DIOXIDE
Atmospheric Chemistry
Effects of increased CO_2 on photosynthesis and agricultural productivity. Volume II, Part 6. Environmental and societal consequences of a possible CO_2-induced climate change, 8:13025 (R:US)
Environmental Effects
Foreseeable effects of CO_2-induced climatic change: freshwater concerns, 8:13034 (J:CH)
Environmental Impacts
Research issues in grazing lands under changing climate. Volume 12, Part 16. Environmental and societal consequences of a possible CO_2-induced climate change, 8:13061 (R:US)
Fermentation
Clostridium thermoautotrophicum species novum, a thermophile producing acetate from molecular hydrogen and carbon dioxide, 8:12105 (J:US)
Greenhouse Effect
Effects of increased CO_2 on photosynthesis and agricultural productivity. Volume II, Part 6. Environmental and societal consequences of a possible CO_2-induced climate change, 8:13025 (R:US)
Marketing Research
Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Market survey and economic analysis, 8:11978 (R:US)
Monitoring
Increase of total CO_2 in the world oceans. Annual progress report, 8:13081 (R:US)

CARBON DIOXIDE FIXATION
Stimulation
Amino acid synthesis in photosynthesizing spinach cells: effects of ammonia on pool sizes and rates of labeling from $^{14}CO_2$, 8:13122 (J:US)

CARBON DIOXIDE INJECTION
Bench-Scale Experiments
Determination of miscibility pressure by direct-observation method. Quarterly report, July 1-September 30, 1982, 8:11797 (R:US)

CARBON IONS
Ion Sources
Study on laser plasma as a source of multicharged ions for cyclotrons in the light element range (Li,Be,C), 8:12922 (R:SU:In Russian)

CARBON MONOXIDE
Air Pollution Abatement
Plasma-jet ignition in a lean-burn CFR engine, 8:12645 (R:US)
Chemical Reaction Kinetics
Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen, 8:12787 (R:US)
Chemical Reaction Yield
Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen, 8:12787 (R:US)
Chemisorption
H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R:US)
Methanation
Chem Systems' Liquid Phase Methanol process, 8:11985 (RA:US)
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
Method for the preparation of a gaseous fuel (Dutch patent), 8:11991 (TG:GB)

Preparation and characterization of ligand types intermediate in the metal catalyzed conversion of coal to methane, methanol, and higher alkanes and alcohols. Final progress report, September 1, 1978-June 30, 1982, 8:11598 (R:US)

Monitoring

Resumption of exploratory drilling operations by Texaco, Inc.: state oil and gas lesses - PRC 2725.1 (Jade Prospect), PRC 2206.1 (Anita Prospect), PRC 2955.1 (Refugio Prospect), Santa Barbara County. Final environmental impact report, 8:13101 (R:US)

CARBON OXIDE SULFIDE

See CARBON OXYSULFIDE

CARBON OXYSULFIDE

Molecular Beams

Molecular-beam photoionization studies of molecules and their van der Waals clusters, 8:12815 (R:US)

Performance Testing

Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)

Removal

Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)

CARBON STEELS

Corrosion Resistance

Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)

CARBON SULFIDES

Molecular Beams

Molecular-beam photoionization studies of molecules and their van der Waals clusters, 8:12815 (R:US)

CARBONATE ROCKS

Hydrothermal Alteration

Carbonate equilibria in hydrothermal systems: first ionization of carbonic acid in NaCl media to 300°C, 8:12254 (J:GB)

CARBONATES

Catalytic Effects

Catalyzed gasification of coal: isotope and XPS studies, 8:11644 (R:US)

CARBONYL SULFIDE

See CARBON OXYSULFIDE

CARBONYLS

Only for compounds of metals with carbonyl radicals.

Crystal Structure

Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)

Molecular Structure

Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)

Synthesis

Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)

CARBOXYLIC ACIDS

See also AMINO ACIDS

Esterification

Correlation of petroleum component properties for caustic flooding, 8:12772 (J:US)

Gas Chromatography

Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)

Mass Spectroscopy

Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)

Structural Chemical Analysis

Correlation of petroleum component properties for caustic flooding, 8:12772 (J:US)

Synthesis

Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)

CARCINOGENESIS

Biological Models

Oncogenic action of ionizing radiation on rat skin. Comprehensive progress report, February 1, 1980-January 31, 1983, 8:13141 (R:US)

CARCINOGENS

Biological Effects

DNA damage and carcinogenesis, 8:13172 (BA:US)

Chemical Reactions

Impact of energy-related pollutants on chromosome structure. Progress report, January 1, 1982-December 31, 1982, 8:13182 (R:US)

Toxicity

Session X: regulatory risk assessment, 8:13187 (BA:US)

CARCINOMAS

Biological Effects

Marrow-tumor interactions: the role of the bone marrow in controlling chemically induced tumors. Annual progress report, August 1, 1981-July 31, 1982, 8:13118 (R:US)

Diagnosis

Histochemistry of NADH diaphorase and γ-glutamyltranspeptidase in rat bladder tumors, 8:13112 (J:US)

CARGO

Transport

Intercity freight movement and energy issues, 8:12587 (RA:US)

Least-energy operation of river shipping, 8:12588 (RA:US)

CASCADE MOUNTAINS

See also MT ST HELENS

Geologic Faults

Faults and lineaments of the Southern Cascades, Oregon. Special paper No. 13, 8:13207 (R:US)

Geological linears of the northern part of the Cascade Range, Oregon. Special paper No. 12, 8:13208 (R:US)

Geologic Structures

Faults and lineaments of the Southern Cascades, Oregon. Special paper No. 13, 8:13207 (R:US)

Geological linears of the northern part of the Cascade Range, Oregon. Special paper No. 12, 8:13208 (R:US)

CASINGS

See COVERINGS

CASSAVA

Fermentation

Microwaves and the industrial production of ethanol, 8:12036 (RA:BR)

Food Processing

Microwaves and the industrial production of ethanol, 8:12036 (RA:BR)

CASTE (INSECTS)

See INSECTS

CASTINGS

X-Ray Radiography

Evaluation of a computer aided X-ray fluorographic system: part 1 - system analysis, 8:12876 (R:GB)

CATALYSIS

Meetings

Seventh North American meeting of the Catalysis Society, 8:12774 (R:US)

CATALYSTS

Chemical Preparation

Development of new catalysts for coal liquids refining. Final report, January 1979-April 1981, 8:11615 (R:US)

H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R:US)

Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R:US)

Liquid-hydrocarbon fuels from syngas. Quarterly report, March 1982-May 1982, 8:11963 (R:US)

Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982, 8:11645 (R:US)

New catalysts for coal-liquid upgrading. Quarterly report, September 1-December 31, 1982, 8:11637 (R:US)

Structural characteristics of cobalt particles in a 9.5%Co-ZSM-5 catalyst. Semiannual report, May 18, 1982-November 18, 1982, 8:11639 (R:US)
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R:US)
Comparative Evaluations
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.2 (152 references), 8:11630 (R:US)
Coal-liquefaction catalyst development. Annual report No. 1, April 1, 1979-June 30, 1980, 8:11617 (R:US)
New catalysts for coal-liquid upgrading. Quarterly report, September 1-December 31, 1982, 8:11637 (R:US)
Crystal Structure
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)
Deactivation
Integrated two-stage liquefaction. Topical technical progress report completion of Indiana V program, April 1, 1981-September 30, 1981, 8:11618 (R:US)
Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R:US)
Molecular Structure
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)
Optimization
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No. 3, 8:11631 (R:US)
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.2 (152 references), 8:11630 (R:US)
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.1, 8:11629 (R:US)
Performance Testing
Coal-liquefaction catalyst development. Annual report No. 1, April 1, 1979-June 30, 1980, 8:11617 (R:US)
Development of new catalysts for coal liquids refining. Final report, January 1979-April 1981, 8:11615 (R:US)
Liquid-hydrocarbon fuels from syngas. Quarterly report, March 1982-May 1982, 8:11963 (R:US)
Research Programs
Coal-liquefaction catalyst development. Annual report No. 1, April 1, 1979-June 30, 1980, 8:11617 (R:US)
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R:US)
Surface Properties
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R:US)
Synthesis
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)
Testing
H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R:US)
Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982, 8:11645 (R:US)

CAVITY RESONATORS
See also SUPERCONDUCTING CAVITY RESONATORS
Tuning
Study on the supercyclotron cavity model excitation, 8:12920 (R:SU:In Russian)

CDC COMPUTERS
Equipment Interfaces
Communications interface for the PDP-11 and the Nuclear Data 6600, 8:13444 (R:US)

CELL FLOW SYSTEMS
Automation
Automated flow microfluorometer and cell sorter incorporating nuclear electronics, 8:13117 (R:US)
Computerized Control Systems
Automated flow microfluorometer and cell sorter incorporating nuclear electronics, 8:13117 (R:US)

CELL GROWTH (ANIMAL)
See ANIMAL CELLS

CELL PROLIFERATION
Inhibition
Cytogenetic effects of inhaled benzene in murine bone marrow, 8:13188 (BA:US)

CELLOBIOSE
Fermentation
Conversion of cellulose to ethanol by mesophilic bacteria. Progress report and third year budget, 8:11971 (R:US)
Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms, 8:13135 (BA:US)

CELLS (ANIMAL)
See ANIMAL CELLS

CELLS (ELECTROLYTIC)
See ELECTROLYTIC CELLS

CELLS (REACTOR)
See REACTOR CELLS

CELLULOSE
Biosynthesis
Regulatory mechanisms in Thielavia terrestris. Final report, 8:13134 (R:US)
Fermentation
Conversion of cellulose to ethanol by mesophilic bacteria. Progress report and third year budget, 8:11971 (R:US)
Pyrolysis
Effects of pressure on biomass pyrolysis, 8:12077 (RA:US)

CEMENTS
Leaching
Strontium leachability of hydrofracture grouts for sludge-slurries, 8:11866 (R:US)

CENTRAL HEATING PLANTS
Economics
CHP: planning, technology, costs; the application of combined heat and power in a medium-sized city, 8:12642 (TJ:GB)
Planning
CHP: planning, technology, costs; the application of combined heat and power in a medium-sized city, 8:12642 (TJ:GB)

CENTRAL RECEIVERS
Engineering Drawings
Pilot-plant station manual (RADL Item 2-1). Volume III. Equipment data. 10-MWe solar-thermal central-receiver pilot plant: solar-facilities design integration, 8:12121 (R:US)
Specifications
Pilot-plant station manual (RADL Item 2-1). Volume III. Equipment data. 10-MWe solar-thermal central-receiver pilot plant: solar-facilities design integration, 8:12121 (R:US)

CERAMIC MELTERS
Theoretical predictions for continuous-slurry feeding of a glass melter, 8:11879 (R:US)
Off-Gas Systems
Efficient particulate scrubber for glass melter off-gas, 8:11880 (R:US)

CERAMICS
Fabrication
Fireproof ceramics and process for their manufacture, 8:12717 (TG:US)
Mechanical Properties
Failure of ceramics from multiaxial stresses. Second progress report, November 2, 1981-October 31, 1982, 8:12705 (R:US)
Wear Resistance
Fireproof ceramics and process for their manufacture, 8:12717 (TG:US)

CEREBRUM
Blood Flow
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)

CERIUM
Absorption Spectra
Double excitation structure in the L-edge X-ray absorption spectra of α-cerium, 8:12662 (R:DE)

Crystal-Phase Transformations
Photoemission study of the 4f character in gamma- and alpha-cerium, 8:12680 (R:US)
Electronic Structure
Photoemission study of the 4f character in gamma- and alpha-cerium, 8:12680 (R:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Precipitation
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Solubility
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)

CERIUM 140 TARGET
Neutron Reactions
Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R:NL)

CERIUM 141
P States
Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R:NL)

CERIUM 142 TARGET
Neutron Reactions
Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R:NL)

CERIUM 143
P States
Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R:NL)

CERIUM 148
Decay
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)

CERIUM COMPLEXES
Valence
Physical-chemical studies of transuranium elements. Progress report, April 1, 1982-March 31, 1983, 8:12775 (R:US)

CERN LINAC
Neutron Dosimetry
Hadron personnel monitoring around high-energy proton accelerators, 8:12981 (RA:US)

CERRO PRIETO GEOTHERMAL FIELD
Gravity Surveys
Repetitive precision gravity studies at the Cerro Prieto and Heber geothermal fields, 8:12201 (R:US)

CESIUM
Absorption Spectroscopy
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Adsorption
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Solvent Extraction
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)

CESIUM 137
Diffusion
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Radioecological Concentration
Mathematical simulation of sediment and radionuclide transport in estuaries, 8:13089 (R:US)
Sediment and radionuclide transport in rivers: radionuclide transport modeling for Cattaraugus and Buttermilk Creeks, New York, 8:13090 (R:US)
Vitrification
Cesium glass irradiation sources, 8:11947 (R:US)

CESIUM COMPLEXES
Reduction
Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_3Mo_2Cl_8H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters, 8:12785 (R:US)

CESIUM ISOTOPES
See also CESIUM 137
Beta-Plus Decay
Strength functions of βi decay of cesium isotopes, 8:13329 (RA:SU:In Russian)

CETANE NUMBER
See ANTIKNOCK RATINGS

CETENE NUMBER
See ANTIKNOCK RATINGS

CFFF
See MHD GENERATOR CFFF

CHALCOGENIDES
See also OXIDES
SULFIDES
Molecular Structure
Halide and chalcogenide clusters of the early transition metals, 8:12784 (R:US)

CHALK RIVER NUCLEAR LABS
Neutron Dosimetry
Calculations on neutron dosimetry at the Chalk River Nuclear Laboratory, 8:13397 (RA:US)

CHARGED-PARTICLE ACTIVATION
See ACTIVATION ANALYSIS

CHARPAK CHAMBERS
See MULTIWIRE PROPORTIONAL CHAMBERS

CHARS
Combustion Kinetics
On the temperature and reaction rate of burning pulverized fuels (Petroleum coke and flash pyrolysis char), 8:11815 (RA:US)
Temperature and reaction rate of burning pulverized fuels (Petroleum coke and a flash pyrolysis char of an Australian subbituminous coal), 8:11771 (R:US)
Electrochemistry
Survey of the electrochemistry of some biomass-derived compounds, 8:12097 (R:US)
Fluidization
Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)
Sintering
Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)
Specifications
Application of the Toscoal process to the electric utility industry, 8:12269 (RA:US)

CHELATING AGENTS
Biological Effects
Enhancement of radiopharmaceutical excretion by chemical interventions, 8:13176 (R:US)
Radiation Protection
Enhancement of radiopharmaceutical excretion by chemical interventions, 8:13176 (R:US)

CHEMICAL ANALYSIS
See also ACTIVATION ANALYSIS
NONDESTRUCTIVE ANALYSIS
QUANTITATIVE CHEMICAL ANALYSIS
Meetings
VOREM 80. Conference proceedings, 8:12753 (R:CS:CZ)
Quality Assurance
Quality assurance for environmental analytical chemistry at Los Alamos, 8:13028 (R:US)

CHEMICAL DOSEMETERS
Chemical Properties
Personnel neutron dosimeter utilizing radiochromic dyes, 8:12976 (RA:US)

CHEMICAL EXPLOSIVES
See also NITROCELLULOSE
Aging
Effect of thermal aging on the thermal stability and friction sensitivity of explosives, 8:13009 (R:US)
Detonators
Arming and firing system for PRE-DIRECT COURSE, 8:13011 (R:US)
Mechanical Properties
PBX-9407 mechanical properties, 8:13012 (R:US)
Performance Testing
Reproducibility of the Langlie Technique for establishing probabilities of LX-10 skid initiation, 8:13010 (R:US)
Sensitivity
Effect of thermal aging on the thermal stability and friction sensitivity of explosives, 8:13009 (R:US)
Reproducibility of the Langlie Technique for establishing probabilities of LX-10 skid initiation, 8:13010 (R:US)
Thermal Degradation
Effect of thermal aging on the thermal stability and friction sensitivity of explosives, 8:13009 (R:US)
CHEMICAL INDUSTRY
Boiler Fuels
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
Chemical Feedstocks
Turn in the road: Eastman chemicals from coal, 8:11596 (RA:US)
Energy Accounting
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
Energy Analysis
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
Energy Conservation
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
Energy Demand
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
CHEMICAL MUTAGENS
See MUTAGENS
CHEMICAL PLANTS
Process Control
Extension of the Smith predictor, 8:12793 (R:US)
Reliability
Reliability studies applied to plant safety, 8:12884 (TJ:GB)
Safety
Reliability studies applied to plant safety, 8:12884 (TJ:GB)
Safety Standards
Reliability studies applied to plant safety, 8:12884 (TJ:GB)
Wood Fuels
Feasibility study of the production and use of wood-derived fuels in a large chemical plant. Final report, 8:12052 (R:US)
CHEMICAL REACTORS
Comparative Evaluations
Comparative analysis of peat gasification reactor configurations, 8:11606 (RA:US)
Control
Comparative analysis of peat gasification reactor configurations, 8:11611 (RA:US)
Design
Comparative analysis of peat gasification reactor configurations, 8:11611 (RA:US)
Development of an indirectly heated pyrolysis reactor, 8:11964 (RA:US)
High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982, 8:12057 (R:US)
System design for wood gasification using internal heating, 8:12073 (RA:US)
Multiphase Flow
Gas/slurry flow in coal-liquefaction processes (fluid dynamics in a three-phase-flow column). Final technical progress report, 1 October 1979-31 March 1982, 8:11616 (R:US)
Pressure Dependence
Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)
Process Control
Extension of the Smith predictor, 8:12793 (R:US)
Scaling Laws
Gas/slurry flow in coal-liquefaction processes (fluid dynamics in a three-phase-flow column). Final technical progress report, 1 October 1979-31 March 1982, 8:11616 (R:US)
Size
Gas/slurry flow in coal-liquefaction processes (fluid dynamics in a three-phase-flow column). Final technical progress report, 1 October 1979-31 March 1982, 8:11616 (R:US)
Solar Receivers
High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982, 8:12057 (R:US)
Technology Assessment
Thagard high-temperature fluid-wall reactor for syngas generation from biomass, 8:12091 (RA:US)
Thermal Efficiency
Comparative analysis of peat gasification reactor configurations, 8:11611 (RA:US)
CHEMICAL SPILLS
Environmental Impacts
Evaporation of phenols from synthetic liquid fuel spills, 8:13082 (J:GB)
CHEMICALS
See CARCINOGENS
CHELATING AGENTS
MUTAGENS
SURFACTANTS
CHEMISTRY
See also BIOCHEMISTRY
NUCLEAR CHEMISTRY
PHOTOCHEMISTRY
RADIATION CHEMISTRY
Meetings
Petroleum chemistry and petroleum processing. Chemical problems of gas and oil production. Core chemistry and technology of synthetic liquid fuel. V. 4, 8:12745 (R:SU:RU)
Research Programs
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
CHERENKOV COUNTERS
Energy Resolution
Lead-glass gamma-ray detector for relativistic heavy-ion collisions, 8:12995 (J:NL)
CHERENKOV DETECTORS
See CHERENKOV COUNTERS
CHLAMYDOMONAS
Dose-Response Relationships
Microdosimetry of 0.5 to 2.0 MeV electron beams, 8:13392 (R:US)
CHLOR-ALKALI INDUSTRY
See CHEMICAL INDUSTRY
CHLORINE
SODIUM HYDROXIDES
CHLORIDES
See also CALCIUM CHLORIDES
SODIUM CHLORIDES
ZIRCONIUM CHLORIDES
Ion Exchange Chromatography
Applications of ion chromatography, 8:12747 (R:US)
Separation Processes
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Solubility
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Synthesis
Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_3Mo_2Cl_6H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters, 8:12785 (R:US)
CHLORINATED ALICYCLIC HYDROCARBONS
Molecular Structure
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R:US)

Monoclinic Lattices
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R:US)

CHLORINATED AROMATIC HYDROCARBONS
Excited States
Triplet excitons in 4,4'-dichlorobenzophenone, 8:12817 (J:US)
Gas Chromatography
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Mass Spectroscopy
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Monoclinic Lattices
Triplet excitons in 4,4'-dichlorobenzophenone, 8:12817 (J:US)

CHLORINE
Activation Analysis
Simultaneous determination of antimony and chlorine in synthetic rubbers by 14 MeV neutron activation analysis, 8:12765 (J:CH)
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

CHLORINE CHLORIDES
See CHLORINE

CHLOROPHYLL
Electron Transfer
Role of porphyrins and chlorophylls in artificial photosynthesis, 8:12816 (R:US)
Molecular Biology
Energy transfer in self-assembled chlorophyll a systems, 8:13110 (J:GB)

CHONDRITES
Chemical Composition
Organic compounds in meteorites and their origins, 8:13234 (J:DE)

CHROMATIN
See also NUCLEOSOMES
Molecular Structure
Impact of energy-related pollutants on chromosome structure. Progress report, January 1, 1982-December 31, 1982, 8:13182 (R:US)
Neutron Diffraction
Neutron scattering studies and modeling of high mobility group 14 core nucleosome complex, 8:13105 (J:US)

CHROMIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

CHROMIUM ALLOYS
See also ALLOY-HK-40
ALLOY-RA-333
HASTELLOY X
HAYNES 188 ALLOY
HAYNES STELLITE 6B
INCONEL 671
STAINLESS STEELS
Eutectoids
Revision of the eutectoid isotherms of the uranium-chromium system, 8:12692 (R:US)

CHROMIUM COMPLEXES
Decomposition
Kinetic and mechanistic studies of the reactions of selected aliphatic radicals with metal complexes and the decomposition of organoperoxy cobalt complexes, 8:12788 (R:US)
Electrochemistry
Kinetic studies of organocobalt compounds related to vitamin B_{12} coenzymes, 8:12786 (R:US)

CHROMIUM HYDRIDES
Phase Studies
Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen, and vanadium alloys, 8:12712 (R:US)

CHROMIUM-MOLYBDENUM STEELS
Carburization
Assessment of carburization-decarburization behaviour of Fe-9Cr-Mo steels in a sodium environment, 8:12693 (J:NL)
Decarburization
Assessment of carburization-decarburization behaviour of Fe-9Cr-Mo steels in a sodium environment, 8:12693 (J:NL)
Heat Treatments
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)
Mechanical Properties
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Modifications
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)

CHROMODYNAMICS
See QUANTUM CHROMODYNAMICS

CIRCULAR POINT COLLECTORS
See PARABOLIC DISH COLLECTORS

CITIES
See URBAN AREAS

CLASSIFIED INFORMATION
Control
Control of information as an element of nuclear safeguards, 8:11942 (R:US)
Physical Protection
Control of information as an element of nuclear safeguards, 8:11942 (R:US)

CLATHRATES
Oxidation
Synthesis and characterization of oxide interstitial derivatives of zirconium monochloride and monobromide, 8:12791 (R:US)

CLAYS
See also ILLITE
MONTMORILLONITE
Rheology
Clay-based geothermal drilling fluids, 8:12249 (R:US)

CLEAN AIR ACT
Compliance
Bubbles, existing and new under the Clean Air Act (Compliance based on total plant emission rather than limits on each boiler), 8:13051 (RA:US)

CLIMATES
Climate, energy demands and energy consumption with special regard to human settlements, 8:12553 (RA:CH)
Climate and energy, 8:12001 (RA:CH)
Information Dissemination
Climate data for energy programmes, 8:12002 (RA:CH)

CLINCH RIVER BREEDER REACTOR
Environmental Impact Statements
Supplement to Final Environmental Statement related to construction and operation of Clinch River Breeder Reactor Plant, Docket No. 50-537, 8:12366 (R:US)
Fuel Pellets
Improved specifications for fast reactor fuel, 8:12370 (R:US)
Fuel Pins
Improved specifications for fast reactor fuel, 8:12370 (R:US)
Radiation Protection
CRBRP radiation protection ALARA program, 8:12440 (J:US)

CLINTON P. ANDERSON MESON PHYSICS FACILIT
See LAMPF LINAC

CLOSTRIDIUM
Biology
Clostridium thermoautotrophicum species novum, a thermophile producing acetate from molecular hydrogen and carbon dioxide, 8:12105 (J:US)
Physiology
Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms, 8:13135 (BA:US)

CLOTHES DRYERS
Solar Heating Systems
Demonstrate use of solar energy for laundromat washing and drying. Final report, 8:12171 (R:US)

CLOTHES WASHERS
Solar Heating Systems
Demonstrate use of solar energy for laundromat washing and drying. Final report, 8:12171 (R:US)

CLOUD COVER
Data Processing
Cloud-cover estimation: use of GOES imagery in development of cloud-cover data base for insolation assessment, 8:12012 (R:US)
Mathematical Models
Cloud-cover estimation: use of GOES imagery in development of cloud-cover data base for insolation assessment, 8:12012 (R:US)

CLOUDINESS (METEOROLOGY)
See CLOUD COVER

CLOUDS
Limited to clouds in the earth atmosphere; for interstellar clouds see COSMIC DUST or COSMIC GASES.
Atmospheric Precipitations
Cloud water: an important vector of atmospheric deposition, 8:13020 (R:US)

CLUSTERS (FUEL ELEMENTS)
See FUEL ELEMENT CLUSTERS

CO2 FLOODING
See CARBON DIOXIDE INJECTION

COAGULATION (BLOOD)
See BLOOD COAGULATION

COAL
See also BROWN COAL
Chemical Analysis
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Solvent and chemical-reaction effects in supercritical extraction of coal. Fifth quarterly technical progress report, September 1-November 30, 1982, 8:11636 (R:US)
Chemical Composition
Predictors of plasticity in bituminous coals. Technical progress report No. 5, 8:11672 (R:US)
Relation of coal characteristics to liquefaction behavior. Final technical report, July 1976 to February 1981. Part III. Mechanistic studies, product distributions and supportive analytical investigations , 8:11613 (R:US)
Chemical Properties
Some inconsistencies in current concepts of coal science, 8:11674 (RA:US)
Combustion
Boiler efficiency and emissions testing using refuse-derived fuel (RDF) and coal, Wright-Patterson Air Force Base, Ohio 45433. Final report 21-26 Feb 82, 8:12892 (R:US)
Industrial coal utilization: fourth annual symposium, 8:11780 (R:US)
Particulate processes in pulverized-coal flames. Quarterly technical progress report, April-June, 8:11766 (R:US)
Comminution
Economics of coal preparation, 8:11743 (RA:US)
Cost
Commercial energy costs for SOLCOST Data Bank cities, winter 1981-1982, 8:12014 (R:US)
Deashing
Benefits of coal preparation, 8:11742 (RA:US)
Canadian low-rank coals: resources, conversion and utilization, 8:11722 (RA:US)
Desulfurization
Benefits of coal preparation, 8:11742 (RA:US)
Electron Microscopy
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Environmental Impacts
Environmental impacts of energy utilization, 8:12468 (R:BR:In Portuguese)
Exports
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Future coal export demand and its effect on the United States market (USA), 8:11746 (RA:US)
Fluidized-Bed Combustion
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Tennessee Valley Authority's atmospheric fluidized bed combustion program, 8:11759 (RA:US)
Freeze Protection
Project to develop and demonstrate methods to eliminate frozen-coal-handling problems. Final report, 8:11753 (R:US)
Freezing
Project to develop and demonstrate methods to eliminate frozen-coal-handling problems. Final report, 8:11753 (R:US)
Fuel Substitution
Makret place economics and coal conversions (Cents/million Btu; 1975 to 1981), 8:12268 (RA:US)
Gas Chromatography
Predictors of plasticity in bituminous coals. Technical progress report No. 5, 8:11672 (R:US)
Government Policies
Energy, Texas, and the country, 8:12494 (RA:US)
Gravimelt Process
Gravimelt process development. Quarterly technical progress report, 8:11755 (R:US)
Hydraulic Transport
Transportation of coal by slurry pipelines, 8:11745 (RA:US)
Imports
Notes for an address on coal, 8:11787 (R:CA)
Macerals
Direct determination of organic sulfur in coal by electron-beam microanalysis, 8:11677 (R:US)
Market
Coal supply factor is it largely romance or a solid plus, 8:11773 (RA:US)
Future coal export demand and its effect on the United States market (USA), 8:11746 (RA:US)
Materials Handling
Project to develop and demonstrate methods to eliminate frozen-coal-handling problems. Final report, 8:11753 (R:US)
Research and development leading to the preparation of a gravity flow of solids media engineering databook for coal conversion and utilization processes. Phase I. Final technical report, 8:11752 (R:US)
Mixing
Coal slurry mixing: residence time and temperature effects on SRC feed slurries, 8:11655 (R:US)
Petrography
Petrographic characterization of Kentucky coals. Quarterly progress report, September 1982 - November 1982, 8:11669 (R:US)
Predictors of plasticity in bituminous coals. Technical progress report No. 5, 8:11672 (R:US)
Plasticity
Predictors of plasticity in bituminous coals. Technical progress report No. 5, 8:11672 (R:US)
Prices
Makret place economics and coal conversions (Cents/million Btu; 1975 to 1981), 8:12268 (RA:US)
Production
Activities in low-rank coal in the Northern Great Plains (Great Plains; 1920 to 1980), 8:11720 (RA:US)
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Low-rank coal exploitation and utilization in east European countries (USSR; 1950 to 1979), 8:11734 (RA:US)
Moving coal by rail (USA; forecasting), 8:11744 (RA:US)

Summary of mineral industry activities in Colorado. Part I: coal, 8:11784 (R:US)

Pyrolysis
Application of the Toscoal process to the electric utility industry, 8:12269 (RA:US)
Investigation of vaporization and devolatilization of coal/water mixtures. Second quarterly report, July 20, 1982-October 19, 1982, 8:11642 (R:US)
Predictors of plasticity in bituminous coals. Technical progress report No. 5, 8:11672 (R:US)

Rail Transport
Moving coal by rail (USA; forecasting), 8:11744 (RA:US)

Rate Structure
Rate guide for commercial No. 2 heating oil and coal, 8:11781 (R:US)

Research Programs
Canadian low-rank coals: resources, conversion and utilization, 8:11722 (RA:US)
Coal: the refocused federal program (US DOE), 8:11581 (RA:US)
RD and D initiatives for low-rank coals: follow-up to the low-rank coal study (USA; low rank), 8:11582 (RA:US)

Retail Prices
Rate guide for commercial No. 2 heating oil and coal, 8:11781 (R:US)

Solvent Extraction
Predictors of plasticity in bituminous coals. Technical progress report No. 5, 8:11672 (R:US)

Structural Models
Some inconsistencies in current concepts of coal science, 8:11674 (RA:US)

Sulfur Content
Petrographic characterization of Kentucky coals. Quarterly progress report, September 1982 - November 1982, 8:11669 (R:US)

Supercritical Gas Extraction
Solvent and chemical-reaction effects in supercritical extraction of coal. Fifth quarterly technical progress report, September 1-November 30, 1982, 8:11636 (R:US)
Supercritical fluids for extraction and reaction of coal and heavy oils. First quarterly progress report, September 1, 1982-December 1, 1982, 8:11633 (R:US)
Use of supercritical water for extraction of low rank coals, 8:11634 (RA:US)

Supply and Demand
Documentation of the Resource Allocation and Mine-Costing (RAMC) model, 8:11783 (R:US)
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)

Technology Transfer
Canadian low-rank coals: resources, conversion and utilization, 8:11722 (RA:US)

Thermal Degradation
Thermolysis of model compounds for coal. 2. Condensation and hydrogen transfer during thermolysis of naphthols, 8:11665 (J:US)

Thermal Gravimetric Analysis
Structural characteristics and relationships in low-rank coals, 8:11676 (RA:US)

Transport
Benefits of coal preparation, 8:11742 (RA:US)
Coal supply factor is it largely romance or a solid plus, 8:11773 (RA:US)
Economics of coal preparation, 8:11743 (RA:US)
Future coal export demand and its effect on the United States market (USA), 8:11746 (RA:US)
Industrial coal utilization: fourth annual symposium, 8:11780 (R:US)
Notes for an address on coal, 8:11787 (R:CA)
Project to develop and demonstrate methods to eliminate frozen-coal-handling problems. Final report, 8:11753 (R:US)

Water Removal
Benefits of coal preparation, 8:11742 (RA:US)
Canadian low-rank coals: resources, conversion and utilization, 8:11722 (RA:US)

COAL DEPOSITS
Policy and planning for the development of deep basin lignite on the Gulf Coast, 8:11726 (RA:US)

Classification
Advanced Coal-Extraction-Systems Project: report of activities for fiscal year 1980-1981, 8:11716 (R:US)

Evaluation
Advanced Coal-Extraction-Systems Project: report of activities for fiscal year 1980-1981, 8:11716 (R:US)

Exploration
Coal conversion in New Zealand: the South Island lignite programme, 8:11724 (RA:US)

Geology
Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA:US)

Leasing
Status of Gulf Coast lignite activity, 8:11721 (RA:US)

Resource Assessment
Study of the United States coal resources (Appalachian Plateau, Interior Basins, Gulf Coastal Plain, Rocky Mountain Basins, High Plains, North Alaska), 8:11717 (R:US)

Stratigraphy
Status of Gulf Coast lignite activity, 8:11721 (RA:US)

COAL FINES
Briquetting
Binderless briquetting of coal powders by an acetone treatment process (MS Thesis), 8:11757 (R:US)
Coal-gasification basic research and costs studies. Quarterly report No. 4, 8:11620 (R:US)

Combustion
Particulate processes in pulverized-coal flames. Quarterly technical progress report, July-September 1982, 8:12830 (R:US)

Devolatilization
Particulate processes in pulverized-coal flames. Quarterly technical progress report, July-September 1982, 8:12830 (R:US)

Ignition
Particulate processes in pulverized-coal flames. Quarterly technical progress report, July-September 1982, 8:12830 (R:US)

COAL GAS
Chemical Reactions
Use of supercritical water for extraction of low rank coals, 8:11634 (RA:US)

COAL GASIFICATION
See also BGC-LURGI SLAGGING PROCESS
BI-GAS PROCESS
CS-R PROCESS
EXXON GASIFICATION PROCESS
KBW GASIFICATION PROCESS
KELLOGG PROCESS
MOLTEN SALT COAL GASIFICATION PROCESS
PEATGAS PROCESS
TEXACO GASIFICATION PROCESS
TOSCOAL PROCESS
U-GAS PROCESS
WESTINGHOUSE GASIFICATION PROCESS

Coal-fired combined-cycle power generating plants of the future, 8:12280 (BA:US)
Electricity generation from coal using fuel cells: preliminary systems analysis, 8:12537 (BA:US)
Energy and technology review, 8:11663 (R:US)
Seven technologies for the eighties, 8:12470 (R:US)

Bench-Scale Experiments
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)

Catalysts
Catalyzed gasification of coal: isotope and XPS studies, 8:11644 (R:US)
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)

Chemical Reaction Kinetics
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)

Chemical Reactors
Comparative analysis of peat gasification reactor configurations, 8:11611 (RA:US)

Feeding coal and biomass into high pressure reactors, 8:12090 (RA:US)
Commercialization
Commercialization status - DOE programs (Paper identifies 27 coal liquefaction and 25 coal gasification projects giving sponsor, location, major products, size and status), 8:11786 (RA:US)
Demonstration Plants
Lignite in Europe: use, present and future production, 8:11735 (RA:US)
Economics
Comparison of coal and wood as feedstocks for methanol manufacture, 8:11658 (RA:US)
Feasibility Studies
Commercialization status - DOE programs (Paper identifies 27 coal liquefaction and 25 coal gasification projects giving sponsor, location, major products, size and status), 8:11786 (RA:US)
Feasibility study of a Texas lignite-gasification facility to fuel: a small industrial plant. Final report, 8:11785 (R:US)
Hot Gas Cleanup
Systems model of the iron oxide hot gas clean-up process. Volume II. Hotgas user's manual. Final report, September 1979-December 1980, 8:11661 (R:US)
Meetings
Eighth annual international conference on coal gasification, liquefaction, and conversion to electricity, 8:11584 (R:US)
Modifications
Feeding coal and biomass into high pressure reactors, 8:12090 (RA:US)
Phase Studies
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
Process Solutions
Instrumental methods of analysis of sulfur compounds in synfuel process streams. Quarterly technical progress report, July-September 1982, 8:11670 (R:US)
Research Programs
Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals (India), 8:11725 (RA:US)

COAL GASIFICATION PLANTS
Comparative Evaluations
Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report, 8:11662 (R:US)
Constraints
Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report, 8:11662 (R:US)
Corrosion
Effects of coal-gasification atmospheres on pressurized tubes, 8:11647 (R:US)
Cost
Synthetic fuel costs vs oil price (Forecasting; graph shows dependence of copper, aluminum, steel, CE index, CMR index, cement and coal prices on oil prices), 8:11776 (RA:US)
Design
Coal-gasification basic research and costs studies. Quarterly report No. 4, 8:11620 (R:US)
Conceptual integrated gasifier combined-cycle power-plant design. Final report, 8:11621 (R:US)
Economics
When should you build a synthetic fuel plant, 8:11777 (RA:US)
Engineering
Hydrogasification of peat, 8:11610 (RA:US)
Environmental Impacts
Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report, 8:11662 (R:US)
Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs, 8:11681 (R:US)
Failure Mode Analysis
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)
Feasibility Studies
Hydrogasification of peat, 8:11610 (RA:US)
Transco medium-Btu lignite gasification project (Robertson County, TX), 8:11650 (RA:US)
Financial Incentives
Great Plains Gasification Associates project: the nation's first commercial synthetic fuels plant, 8:11649 (RA:US)
Financing
Bottom line: can we finance major synfuels construction in the '80's, 8:11774 (RA:US)
Great Plains Gasification Associates project: the nation's first commercial synthetic fuels plant, 8:11649 (RA:US)
Fuel Supplies
Coal supply factor is it largely romance or a solid plus, 8:11773 (RA:US)
Loan Guarantees
Bottom line: can we finance major synfuels construction in the '80's, 8:11774 (RA:US)
Materials
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Materials Testing
Effects of coal-gasification atmospheres on pressurized tubes, 8:11647 (R:US)
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)
Modifications
Preparation for pilot plant scale peat gasification tests, 8:11605 (RA:US)
Planning
Great Plains Gasification Associates project: the nation's first commercial synthetic fuels plant, 8:11649 (RA:US)
Potential for commercial synthetic fuels in the US energy future, 8:12492 (RA:US)
Turn in the road: Eastman chemicals from coal, 8:11596 (RA:US)
Pressure Vessels
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)
Refractories
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)
Regulations
Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report, 8:11662 (R:US)
Risk Assessment
Bottom line: can we finance major synfuels construction in the '80's, 8:11774 (RA:US)
Site Selection
Coal supply factor is it largely romance or a solid plus, 8:11773 (RA:US)
Socio-Economic Factors
Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report, 8:11662 (R:US)
Solid Wastes
Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs, 8:11681 (R:US)
Technology Assessment
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)
Waste Water
Anaerobic treatment of gasifier effluents. Quarterly report No. 5, 8:11684 (R:US)
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)

COAL INDUSTRY
Computerized Simulation
Documentation of the Resource Allocation and Mine-Costing (RAMC) model, 8:11783 (R:US)
Data Compilation
Summary of mineral industry activities in Colorado. Part I: coal, 8:11784 (R:US)
Energy Models
Documentation of the Resource Allocation and Mine-Costing (RAMC) model, 8:11783 (R:US)
Fuel Cycle
Comparing the health and environmental hazards of different energy systems, 8:13100 (R:US)
Manpower
Forecasts of on-site and off-site occupational requirements for energy-construction developments in the United States, 1982 to 2000, 8:12465 (R:US)
COAL LIQUEFACTION
See also EXXON LIQUEFACTION PROCESS
H-COAL PROCESS
SRC-II PROCESS
SUPERCRITICAL GAS EXTRACTION
TSL PROCESS
Seven technologies for the eighties, 8:12470 (R:US)
Bench-Scale Experiments
Coal conversion in New Zealand: the South Island lignite programme, 8:11724 (RA:US)
Catalysts
H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R:US)
Structural characteristics of cobalt particles in a 9.5%Co-ZSM-5 catalyst. Semiannual report, May 18, 1982-November 18, 1982, 8:11639 (R:US)
Synthetic fuels industry in Germany 1927 to 1945, 8:11778 (RA:US)
Wilsonville Advanced Coal-Liquefaction Research and Development Facility, Wilsonville, Alabama: Run 240 with Illinois 6 coal. Technical progress report (Run 240; non-integrated two stage), 8:11641 (R:US)
Chemical Reaction Kinetics
Relation of coal characteristics to liquefaction behavior. Final technical report, July 1976 to February 1981. Part III. Mechanistic studies, product distributions and supportive analytical investigations , 8:11613 (R:US)
Chemical Reactors
Gas/slurry flow in coal-liquefaction processes (fluid dynamics in a three-phase-flow column). Final technical progress report, 1 October 1979-31 March 1982, 8:11616 (R:US)
Chemistry
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.2 (152 references), 8:11630 (R:US)
Chemical aspects of structure and liquefaction of bituminous coals, 8:11675 (RA:US)
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Final progress report, February 1980-July 1982, 8:11628 (R:US)
Commercialization
Coal liquids: milestones toward commercialization, 8:11591 (RA:US)
Commercialization status - DOE programs (Paper identifies 27 coal liquefaction and 25 coal gasification projects giving sponsor, location, major products, size and status), 8:11786 (RA:US)
Comparative Evaluations
Coal liquids: milestones toward commercialization, 8:11591 (RA:US)
Demonstration Plants
Lignite in Europe: use, present and future production, 8:11735 (RA:US)
Feasibility Studies
Commercialization status - DOE programs (Paper identifies 27 coal liquefaction and 25 coal gasification projects giving sponsor, location, major products, size and status), 8:11786 (RA:US)
Hydrogen Transfer
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Final progress report, February 1980-July 1982, 8:11628 (R:US)
Marketing Research
Coal liquefaction activities in West Germany, 8:11593 (RA:US)
Meetings
Eighth annual international conference on coal gasification, liquefaction, and conversion to electricity, 8:11584 (R:US)
Organic Solvents
Heavy recycle-solvent studies in two-stage coal liquefaction. Second technical progress report, October 1-December 10, 1982, 8:11643 (R:US)
Pilot Plants
Coal liquefaction activities in West Germany, 8:11593 (RA:US)
Planning
Coal liquefaction activities in West Germany, 8:11593 (RA:US)
Process Solutions
Instrumental methods of analysis of sulfur compounds in synfuel process streams. Quarterly technical progress report, July-September 1982, 8:11670 (R:US)
Research Programs
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
COAL LIQUEFACTION PLANTS
Corrosion
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Cost
Synthetic fuel costs vs oil price (Forecasting; graph shows dependence of copper, aluminum, steel, CE index, CMR index, cement and coal prices on oil prices), 8:11776 (RA:US)
Economics
When should you build a synthetic fuel plant, 8:11777 (RA:US)
Environmental Impact Statements
NEPA process and direct coal liquefaction constraint or opportunity, 8:11594 (RA:US)
Environmental Impacts
Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs, 8:11681 (R:US)
Financing
Bottom line: can we finance major synfuels construction in the '80's, 8:11774 (RA:US)
Fuel Supplies
Coal supply factor is it largely romance or a solid plus, 8:11773 (RA:US)
Health Hazards
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Heaters
Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982, 8:11638 (R:US)
Industrial Medicine
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Loan Guarantees
Bottom line: can we finance major synfuels construction in the '80's, 8:11774 (RA:US)
Materials
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Mathematical Models
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Oil Spills
Characterization and analysis of oil-contaminsted soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Pressure Vessels
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Pumps
Techno-economic assessment on the utilization of surge-leg pumps in coal liquefaction, 8:11654 (R:US)
Risk Assessment
Bottom line: can we finance major synfuels construction in the '80's, 8:11774 (RA:US)

Site Selection
Coal supply factor is it largely romance or a solid plus, 8:11773 (RA:US)
Solid Wastes
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs, 8:11681 (R:US)
Values
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Waste Water
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
COAL LIQUIDS
Aging
Evaluation of combustion and cleanup of SRC-II coal-derived liquid fuel, 8:11679 (R:US)
Chemical Analysis
Fluorescence-line-narrowing spectrometry of polycyclic aromatic hydrocarbons in organic glasses, 8:12755 (R:US)
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
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Chemical Composition
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Chemical Reactions
Use of supercritical water for extraction of low rank coals, 8:11634 (RA:US)
Combustion Products
Evaluation of combustion and cleanup of SRC-II coal-derived liquid fuel, 8:11679 (R:US)
Combustion Properties
Evaluation of combustion and cleanup of SRC-II coal-derived liquid fuel, 8:11679 (R:US)
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Gas Chromatography
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Health Hazards
SRC-II product applications - recent developments, 8:11595 (RA:US)
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SRC-II product applications - recent developments, 8:11595 (RA:US)
Infrared Spectra
Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, July 1, 1982-September 30, 1982, 8:11632 (R:US)
Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, October 1-December 31, 1982, 8:11673 (R:US)
Liquid Column Chromatography
Heteroatom speciation in coal liquefaction via FT-IR coupled with liquid chromatography. Quarterly progress report, July 1, 1982-September 30, 1982, 8:11632 (R:US)
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Mass Spectroscopy
Kinetics and mechanism of catalytic hydroprocessing of components of coal-derived liquids. Thirteenth quarterly report, May 16-August 15, 1982, 8:11619 (R:US)
Mutagen Screening
SRC-II product applications - recent developments, 8:11595 (RA:US)
Mutagenesis
Mass and mutagenicity balances in chemical fractionations, 8:13178 (R:US)
Oil Spills
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Refining
Application of the Toscoal process to the electric utility industry, 8:12269 (RA:US)
SRC-II product applications - recent developments, 8:11595 (RA:US)
Reformer Processes
SRC-II product applications - recent developments, 8:11595 (RA:US)
Solubility
Kinetics and mechanism of catalytic hydroprocessing of components of coal-derived liquids. Thirteenth quarterly report, May 16-August 15, 1982, 8:11619 (R:US)
Viscosity
Evaluation of combustion and cleanup of SRC-II coal-derived liquid fuel, 8:11679 (R:US)
COAL MINES
Accidents
Summary of mineral industry activities in Colorado. Part I: coal, 8:11784 (R:US)
Solid Wastes
Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs, 8:11681 (R:US)
COAL MINING
Cost Benefit Analysis
Assessment of benefit-cost analysis for coal-extraction R and D, 8:11738 (R:US)
Health Hazards
Ohio River Basin energy study: health aspects, 8:12284 (R:US)
Technology Assessment
Assessment of benefit-cost analysis for coal-extraction R and D, 8:11738 (R:US)
COAL PREPARATION
Calculation Methods
Introduction to coal preparation, 8:11741 (RA:US)
Comparative Evaluations
Economics of coal preparation, 8:11743 (RA:US)
Introduction to coal preparation, 8:11741 (RA:US)
Cost Benefit Analysis
Benefits of coal preparation, 8:11742 (RA:US)
Cyclone Separators
Flow and design characteristics of the hydrocyclone for the recovery of coal fines. Fifth quarterly report, September 1, 1982-November 30, 1982, 8:11754 (R:US)

Study of hydrocyclone applications to separation processes for coal preparation. Final report, 8:11751 (R:US)
Test Facilities
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals, 8:11725 (RA:US)
Yields
Introduction to coal preparation, 8:11741 (RA:US)
COAL PREPARATION PLANTS
Cost Benefit Analysis
Economics of coal preparation, 8:11743 (RA:US)
Design
Economics of coal preparation, 8:11743 (RA:US)
Economic Analysis
Economics of coal preparation, 8:11743 (RA:US)
Economics
Economics of coal preparation, 8:11743 (RA:US)
Mathematical Models
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Solid Wastes
Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs, 8:11681 (R:US)
COAL RANK
Structural characteristics and relationships in low-rank coals, 8:11676 (RA:US)
COAL RESERVES
Developments in the use of low-rank coal in Australia, 8:11723 (RA:US)
Resource Assessment
Study of the United States coal resources (Appalachian Plateau, Interior Basins, Gulf Coastal Plain, Rocky Mountain Basins, High Plains, North Alaska), 8:11717 (R:US)
COAL TAR
Chemical Analysis
Separation of asphaltenes using high-resolution supercritical-fluid chromatography. Progress report, September 1-November 30, 1982, 8:12750 (R:US)
Hydrogenation
Synthetic fuels industry in Germany 1927 to 1945, 8:11778 (RA:US)
Recycling
British Gas slagging gasifier - a springboard into synfuels, 8:11587 (RA:US)
COAL-DERIVED LIQUIDS
See COAL LIQUIDS
COAL-OIL MIXTURES
See COAL
FUEL OILS
FUEL SLURRIES
COALTEK PROCESS
See FUEL FEEDING SYSTEMS
COASTAL WATERS
Site Surveys
Ecological characterization of the central and northern California coastal region. Volume IV. Watersheds and basins. Chapters 1-16, 8:13070 (R:US)
Ecological characterization of the central and northern Californa coastal region. Volume IV. Watersheds and basins. Chapters 17-29, 8:13071 (R:US)
COATING PROCESSES
See SURFACE COATING
COATING (SURFACE)
See SURFACE COATING
COBALT
Adsorption
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
Catalytic Effects
Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Liquid Column Chromatography
Multicomponent separations using a continuous annular chromatograph, 8:12759 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Structural Chemical Analysis
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Surface Properties
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COBALT 59 TARGET
Carbon 12 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Neon 20 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Proton Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
COBALT 60
Radiation Monitoring
Aerial radiological survey of the Argonne National Laboratory and surrounding area, Argonne, Illinois. Date of survey: May 1977, 8:13064 (R:US)
Radioecological Concentration
Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R:US)
COBALT ALLOYS
See also ALLOY-RA-333
HASTELLOY X
Chemical Preparation
Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga), 8:12697 (J:US)
Hydridation
Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga), 8:12697 (J:US)
COBALT BORIDES
Catalytic Effects
Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R:US)
Reduction
Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982, 8:11645 (R:US)
COBALT COMPLEXES
Chemical Preparation
Poly(tertiary phosphines and arsines). 18. Preparation and structure of bis{μ-[(methylamino)bis(dimethoxyphosphine)]}-bis(dicabonylcobalt), a binuclear complex with approximate square-pyramidal and triganol-bipyramidal coordination of cobalt atoms in the same molecule, 8:12795 (J:US)
Chemical Reaction Kinetics
Kinetics and mechanisms of the reactions of aliphatic free radicals with organocobaloximes and fluoropentaamminecobalt(III) ion, and of iron(III) with methylrhodoxime, 8:12789 (R:US)
Decomposition
Kinetic and mechanistic studies of the reactions of selected aliphatic radicals with metal complexes and the decomposition of organoperoxy cobalt complexes, 8:12788 (R:US)
Kinetic studies of organocobalt compounds related to vitamin B_{12} coenzymes, 8:12786 (R:US)

Reduction
Kinetics and mechanisms of the reactions of aliphatic free radicals with organocobaloximes and fluoropentaamminecobalt(III) ion, and of iron(III) with methylrhodoxime, 8:12789 (R:US)
Structural Chemical Analysis
Poly(tertiary phosphines and arsines). 18. Preparation and structure of bis{μ-[(methylamino)bis(dimethoxyphosphine)]}-bis(dicabonylcobalt), a binuclear complex with approximate square-pyramidal and triganol-bipyramidal coordination of cobalt atoms in the same molecule, 8:12795 (J:US)

COGENERATION
Prior to November 1980, this concept was indexed to CO-GENERATION.
See COGENERATION
Fuel cell cogeneration in the wastewater treatment industry, 8:12543 (BA:US)
Role of fuel cells in industrial cogeneration, 8:12542 (BA:US)
Economic Analysis
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
Fuel Cells
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COGENERATION PLANTS
See DUAL-PURPOSE POWER PLANTS

COILS (MAGNETIC)
See MAGNET COILS

COINCIDENCE METHODS
Reviews
Multicoincidence techniques in atomic physics, 8:13244 (BA:NL)

COKE
Combustion Kinetics
On the temperature and reaction rate of burning pulverized fuels (Petroleum coke and flash pyrolysis char), 8:11815 (RA:US)
Temperature and reaction rate of burning pulverized fuels (Petroleum coke and a flash pyrolysis char of an Australian subbituminous coal), 8:11771 (R:US)

COKE-OVEN GAS
See COAL GAS

COLCHICINE
Biological Effects
Degradation of connective tissue matrices by macrophages. III. Morphological and biochemical studies on extracellular, pericellular, and intracellular events in matrix proteolysis by macrophages in culture, 8:13123 (J:US)

COLLAGEN
Biodegradation
Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture, 8:13116 (J:US)
Biological Effects
Lumen formation by epithelial cell lines in response to collagen overlay: a morphogenetic model in culture, 8:13119 (J:US)

COLLECTIVE ACCELERATORS
See also ELECTRON-RING ACCELERATORS
Electromagnetic Fields
Convergence of a difference approximation of self-consistent system of Maxwell equations on a class of discontinuous solutions, 8:12904 (R:SU:In Russian)

COLLECTIVE MODEL
Effect of zero collective oscillations on observed nuclear properties, 8:13366 (RA:SU:In Russian)
SP Groups
Generating invariants of Sp(6, R) model, 8:13362 (RA:SU:In Russian)

COLLIERIES
See COAL MINES

COLLIMATORS
Mathematical Models
Numerical modeling of a fast-neutron collimator for the Alcator A fusion device, 8:13474 (R:US)

COLLISIONLESS PLASMA
Drift Instability
Steady state linear machine for collisionless plasma studies, 8:13459 (J:GB)
Magnetic Mirror Configurations
Steady state linear machine for collisionless plasma studies, 8:13459 (J:GB)

COLLODION
See NITROCELLULOSE

COLOGNE SPIRITS
See ETHANOL

COLONY FORMATION
Stimulation
Regulation of the colony-stimulating activity produced by a murine marrow-derived cell line (H-1), 8:13120 (J:US)

COLORADO
Coal Industry
Summary of mineral industry activities in Colorado. Part I: coal, 8:11784 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Natural Gas Deposits
Approximation of continuity of lenticular Mesaverde sandstone lenses, utilizing close-well correlations, Piceance Basin, northwest, Colorado. Western Gas Sands Project, 8:11817 (R:US)
Sandstones
Approximation of continuity of lenticular Mesaverde sandstone lenses, utilizing close-well correlations, Piceance Basin, northwest, Colorado. Western Gas Sands Project, 8:11817 (R:US)

COLORIMETRIC DOSEMETERS
Calibration
Gamma and fast neutron dosimetry with leuko dye optical waveguides, 8:12977 (RA:US)
Design
Gamma and fast neutron dosimetry with leuko dye optical waveguides, 8:12977 (RA:US)

COLUMBIA RIVER
Radioactivity
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)

COLUMBIA RIVER BASIN
Geology
Assessment of the effects of surficial geologic processes in the Pasco Basin (Pasco Basin portion), 8:11905 (R:US)

COLUMBIUM
See NIOBIUM

COMANCHE PEAK-1 REACTOR
Radiation Monitoring
Aerial radiological survey of the Comanche Peak Steam Electric Station and surrounding area, Glen Rose, Texas. Date of Survey: March 1982, 8:13039 (R:US)

COMANCHE PEAK-2 REACTOR
Radiation Monitoring
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COMBINED GAS AND STEAM CYCLE POWER PLANTS
See COMBINED-CYCLE POWER PLANTS

COMBINED STEAM-POWER GENERATION
See COGENERATION

COMBINED-CYCLE POWER PLANTS
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Coal Gasification
Coal-fired combined-cycle power generating plants of the future, 8:12280 (BA:US)
Design
Conceptual integrated gasifier combined-cycle power-plant design. Final report, 8:11621 (R:US)
Economics
Conceptual integrated gasifier combined-cycle power-plant design. Final report, 8:11621 (R:US)

Gas Turbines
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Molten Carbonate Fuel Cells
Carbonate fuel cell power plant systems, 8:12544 (BA:US)
Research Programs
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals (India), 8:11725 (RA:US)
Technology Assessment
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COMBUSTION
See also FLUIDIZED-BED COMBUSTION
Additives
Dry-limestone injection test at a low-rank coal-fired power plant. Final report, 8:12282 (R:US)
Diagnostic Techniques
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Environmental Impacts
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Holography
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Mathematical Models
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Meetings
Combustion research presented at the 19th international symposium on combustion, Haifa, Israel, August 8-13, 1982, 8:12832 (R:US)
Reaction Intermediates
Laser spectroscopy of combustion intermediates, 8:12829 (R:US)
Temperature Measurement
On the temperature and reaction rate of burning pulverized fuels (Petroleum coke and flash pyrolysis char), 8:11815 (RA:US)
Test Facilities
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals, 8:11725 (RA:US)

COMMERCIAL BUILDINGS
See also SHOPPING CENTERS
Air Conditioners
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Attached Greenhouses
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COMMERCIAL SECTOR
Energy Consumption
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COMMON MARKET
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COMPACT TORUS
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Plasma Heating
Computational simulation of spheromak plasma heating, 8:13420 (R:US)

COMPLEXES
See also ALKALI METAL COMPLEXES
ALUMINIUM COMPLEXES
CADMIUM COMPLEXES
TRANSITION ELEMENT COMPLEXES
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COMPONENT COOLING SYSTEMS
See AUXILIARY WATER SYSTEMS

COMPOSITE MATERIALS
See also SUPERCONDUCTING COMPOSITES
Fabrication
Residual strain and strength loss in filament wound circular rings. Final report, October 13, 1980-September 30, 1981 (COMCYL), 8:12720 (R:US)

COMPOUND NUCLEI
Level Widths
Total and partial proton widths of the Gamow-Teller resonances, 8:13347 (RA:SU:In Russian)

COMPOUNDS (ORGANIC)
See ORGANIC COMPOUNDS

COMPRESSED AIR ENERGY STORAGE
Aquifers
Compressed-air energy storage preliminary design and site-development program in an aquifer. Volume 4. Aquifer geology. Final report, 8:12449 (R:US)
Risk Assessment
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COMPRESSED AIR STORAGE POWER PLANTS
Site Selection
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Bibliographies
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Computer codes: a bibliography, 8:13546 (R:US)
C Codes
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User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis, 8:12315 (R:US)
L Codes
LAMAP, the Los Alamos National Laboratory mapping code, 8:13554 (R:US)
LOVEL: a low-velocity aerodynamic heating code for flat-plates, wedges, and cones, 8:12872 (R:US)
Libraries
VAXMATH: a mathematical software library for the VAX, 8:13553 (R:US)
M Codes
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Multigroup program for calculating the thermal neutron utilization factor in multizone cylindrical reactor cell (MGPRAKTINETs), 8:12340 (R:SU:In Russian)
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R Codes
RADTRAN II: revised computer code to analyze transportation of radioactive material, 8:11852 (R:US)
Raffle V general purpose Monte Carlo code for neutron and gamma transport, 8:12339 (R:US)
S Codes
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T Codes
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U Codes
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UNSPEC reference manual: 10/29/82 version, 8:13379 (R:US)

COMPUTER LANGUAGES
See PROGRAMMING LANGUAGES
COMPUTER NETWORKS
Array Processors
Controlling a radially-connected array of minicomputers, 8:13555 (R:US)
Data Transmission
Computer-controlled data communications test center, 8:13550 (R:US)
Programming
Software for managing multicrate FASTBUS Systems, 8:13565 (R:US)
COMPUTER PROGRAMMING
See PROGRAMMING
COMPUTER PROGRAMS
See COMPUTER CODES
COMPUTERIZED CONTROL SYSTEMS
Engineering Drawings
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Specifications
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COMPUTERS
See also CDC COMPUTERS
CRAY COMPUTERS
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MICROPROCESSORS
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Supports
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CONCRETES
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
Decontamination
Development of improved technology for decommissioning operations, 8:11903 (R:US)
Neutron Transport
Analysis of dd fusion neutron transport in thick concrete, 8:13515 (J:US)
CONDENSED AROMATICS
See also ANTHRACENE
NAPHTHALENE
PHENANTHRENE
PYRENE
TETRACENE
Biological Effects
Z-DNA conformation of N-2-acetylaminofluorene modified poly(dG-dC).poly(dG-dC) determined by reactivity with anti cytidine antibodies and minimized potential energy calculations, 8:13193 (J:GB)
CONDENSERS (ELECTRIC)
See CAPACITORS
CONES
Aerodynamic Heating
LOVEL: a low-velocity aerodynamic heating code for flat-plates, wedges, and cones, 8:12872 (R:US)
CONNECTICUT
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)

CONNECTIVE TISSUE
Biodegradation
Degradation of connective tissue matrices by macrophages. III. Morphological and biochemical studies on extracellular, pericellular, and intracellular events in matrix proteolysis by macrophages in culture, 8:13123 (J:US)
Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture, 8:13116 (J:US)
Chemical Composition
Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture, 8:13116 (J:US)
CONSERVATION (ENERGY)
See ENERGY CONSERVATION
CONSERVATION LAWS
Finite Difference Method
On a class of high resolution total-variation-stable finite-difference schemes, 8:13413 (R:US)
CONSTRUCTION
Economic Impact
Plant construction and community stress, 8:12509 (J:US)
Social Impact
Plant construction and community stress, 8:12509 (J:US)
CONSTRUCTION INDUSTRY
Manpower
Forecasts of on-site and off-site occupational requirements for energy-construction developments in the United States, 1982 to 2000, 8:12465 (R:US)
CONSUMERS MICHIGAN PALISADES REACTOR
See PALISADES-1 REACTOR
CONTACT RADIOTHERAPY
See RADIOTHERAPY
CONTACTS (ELECTRIC)
See ELECTRIC CONTACTS
CONTAINERS
See also CAPSULES
HOPPERS
PRESSURE VESSELS
TANKS
Impact Tests
Full-scale impact tests of simulated high-level waste canisters, 8:12859 (J:US)
Leaks
Fuel powder transport through container leaks, 8:11860 (J:US)
Performance
Analysis and model testing of a Super Tiger Type B Waste transport system in accident environments, 8:12863 (J:US)
CONTAINMENT BUILDINGS
Deformation
Buckling investigation of ring-stiffened cylindrical shells under unsymmetrical axial loads, 8:12352 (R:US)
Failures
BWR 4/Mark I accident sequences assessment, 8:12415 (R:US)
Thermal Stresses
Hydrogen production during fragmented debris/concrete interactions (PWR; BWR), 8:12419 (R:US)
CONTAINMENT SHELLS
Deformation
Buckling of steel containment shells. Task 1a. Dynamic response and buckling of offshore power systems' floating nuclear plant containment vessel. Final report, 25 August 1980-30 September 1982, 8:12350 (R:US)
Response Functions
Simplified analysis of shells with local, impulsive loads, 8:12402 (R:US)
Stress Analysis
Buckling of steel containment shells. Task 1a. Dynamic response and buckling of offshore power systems' floating nuclear plant containment vessel. Final report, 25 August 1980-30 September 1982, 8:12350 (R:US)
CONTAINMENT SYSTEMS
Pressure Gradients
CONTEMPT 4/MOD 3: a multicompartment containment system analysis program (PWR), 8:12412 (R:US)
Stress Analysis
CONTEMPT 4/MOD 3: a multicompartment containment system analysis program (PWR), 8:12412 (R:US)
Temperature Gradients
CONTEMPT 4/MOD 3: a multicompartment containment system analysis program (PWR), 8:12412 (R:US)
CONTAMINATION
Radiation Monitors
Experience in the calibration of contamination monitors, 8:12962 (RA:DE:In German)
CONTAMINATION (INTERNAL)
See RADIONUCLIDE KINETICS
CONTENT ANALYSIS
See CHEMICAL ANALYSIS
CONTROL ELEMENTS
Optimization
Sensitivity of control times in function of core parameters and oscillations control in thermal nuclear systems, 8:12361 (R:BR:In Portuguese)
CONTROL (RADIOACTIVITY)
See RADIATION MONITORING
CONTROL RODS
See CONTROL ELEMENTS
CONTROL ROOMS
Design
Control and instrumentation, 8:12363 (J:US)
Human Factors Engineering
Control and instrumentation, 8:12363 (J:US)
CONTROL SYSTEMS
For automated processes including feedback.
See also COMPUTERIZED CONTROL SYSTEMS
REACTOR CONTROL SYSTEMS
Design
Consolidated Fuel-Reprocessing Program. Servomanipulator control systems, 8:12840 (R:US)
CONTROL THEORY (REACTOR)
See REACTOR KINETICS
CONVEYORS
Manufacturers
Longwall data bank. Quarterly project status report, August 28-November 28, 1982 and semiannual report No. 3, 8:11731 (R:US)
COOLANTS
See also specific coolant materials.
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
COOLERS
See HEAT EXCHANGERS
COOLING SYSTEMS
Desiccants
Demonstration of desiccant dehumidification components compatible with solar-powered residential cooling systems. Final report, 8:12579 (R:US)
Design
Design evaluation of an improved indirect evaporative cooling system. Final report, 8:12576 (R:US)
Environmental Impacts
Environmental evaluation of European power plant cooling systems: a polish research project, 8:12279 (R:US)
Occurrence of American shad eggs in 1G cooling-water canal, 8:13096 (R:US)
Evaporative Cooling
Demonstration of a low-cost, indirect evaporative cooling system. Final report, 8:12568 (R:US)
Design evaluation of an improved indirect evaporative cooling system. Final report, 8:12576 (R:US)
Heat Recovery
Demonstration ice storage with waste-heat-recovery project. Final report, 8:12570 (R:US)
Ice
Demonstration ice storage with waste-heat-recovery project. Final report, 8:12570 (R:US)
Operation
Environmental evaluation of European power plant cooling systems: a polish research project, 8:12279 (R:US)

Optimization
Energy-conservation potential from optimized mass flow and temperature differences in cooling systems. Final report, 8:12573 (R:US)
Performance Testing
Demonstration of a low-cost, indirect evaporative cooling system. Final report, 8:12568 (R:US)
Demonstration ice storage with waste-heat-recovery project. Final report, 8:12570 (R:US)
Vapor Compression Refrigeration Cycle
Design evaluation of an improved indirect evaporative cooling system. Final report, 8:12576 (R:US)
Water Requirements
Environmental evaluation of European power plant cooling systems: a polish research project, 8:12279 (R:US)

COOLING TOWERS
Blowdown
Waste-heat vertical tube foam evaporation for cooling tower blowdown renovation/recycle. Project summary report, 8:12277 (R:US)

COORDINATED RESEARCH PROGRAMS
Research based on a common plan but carried out in various locations. To be used in coordination with institutions or countries involved.
Federal Republic of Germany
Documentation of initial activities in AGF long-term planning of R+D projects, 8:12479 (R:DE:In German)

COPPER
Catalytic Effects
Catalysts for alcohols from biomass (C_2-C_4 alcohols), 8:11970 (R:US)
Method for the preparation of a gaseous fuel, 8:11991 (TG:GB)
Electrometallurgy
Study of the electrowinning of copper using a fluidized-bed electrochemical reactor, 8:12679 (R:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Liquid Column Chromatography
Multicomponent separations using a continuous annular chromatograph, 8:12759 (R:US)
Magnetization
Superconductivity and magnetism in metallic superlattices, 8:12700 (J:CH)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Physical Radiation Effects
Hardening of irradiated alloys due to the simultaneous formation of vacancy and interstitial loops, 8:12661 (R:US)
Superconductivity
Superconductivity and magnetism in metallic superlattices, 8:12700 (J:CH)

COPPER OXIDES
Catalytic Effects
Methanol synthesis, 8:11984 (RA:US)
Pyrolysis
High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982, 8:12057 (R:US)

COPPER SELENIDES
Superconductivity
Superconductivity and low-temperature phases of Cu/sub x/Mo_6Se_8, 8:12738 (R:US)

COPPER SULFATES
Pyrolysis
High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982, 8:12057 (R:US)

CORES (NUCLEAR)
See NUCLEAR CORES

CORES (REACTOR)
See REACTOR CORES

CORN (MAIZE)
See MAIZE

CORN STOVER
See AGRICULTURAL WASTES
MAIZE

CORNEA
Morphology
LENS* 4: a program for calculation of geometric optics of the human eye, 8:13136 (R:US)

COSMIC GAMMA BURSTS
Origin
Gamma bursts, 8:13231 (R:US)

COSMIC PARTICLES
See COSMIC RADIATION

COSMIC RADIATION
From sources other than the sun; not for SOLAR RADIATION.
Acceleration
Non-LTE astrophysics and the origin of high-energy cosmic rays, 8:13230 (R:US)
Research Programs
Annual report, 1981. Cosmic and subatomic physics, elementary particle physics, mathematical physics, and theoretical high energy physics, 8:13226 (R:SE)

COSMOGONY
See COSMOLOGY

COSMOLOGY
Color Model
Survival of primordial color fluctuations, 8:13232 (J:NL)

COSO HOT SPRINGS
Resource Development
Special requirements and procedures for geothermal development on Navy lands, 8:12226 (RA:US)

COTTONSEED OIL
Cost
Cottonseed oil as a diesel-engine fuel. Final report, 8:12656 (R:US)
Testing
Cottonseed oil as a diesel-engine fuel. Final report, 8:12656 (R:US)
Cottonseed oil as a diesel-engine fuel. Part 2. Appendices. Final report, 8:12657 (R:US)

COULOMB EXCITATION
Theory of Coulomb excitation and ionization, 8:13236 (R:US)

COULOMB IONIZATION
Ionization produced by Coulomb forces between a projectile and the target.
Theory of Coulomb excitation and ionization, 8:13236 (R:US)

COUNTERFLOW COOLING TOWERS
See COOLING TOWERS

COUNTERS (RADIATION)
See RADIATION DETECTORS

COUNTY BUILDINGS
See PUBLIC BUILDINGS

COURT BUILDINGS
See PUBLIC BUILDINGS

COVERINGS
Construction
Handbook for the design, selection, and construction of a rock cover for retired uranium-mill tailings, 8:11902 (R:US)
Design
Handbook for the design, selection, and construction of a rock cover for retired uranium-mill tailings, 8:11902 (R:US)

CRAY COMPUTERS
Computer Codes
NLTSS/LINCS for a presentation to Nuclear Software Systems Division, 8:13567 (R:US)

CREEKS
See STREAMS

CREOSOTE
Hydrogenation
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No. 3, 8:11631 (R:US)
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.2 (152 references), 8:11630 (R:US)

CRITICALITY ACCIDENTS
See RADIATION ACCIDENTS

CROSSFLOW COOLING TOWERS
See COOLING TOWERS

CROWN ETHERS
See POLYETHYLENE GLYCOLS
CRUDE CARRIERS
See TANKER SHIPS
CRUDE OIL
See PETROLEUM
CRYSTAL LATTICES
Irreversible Processes
Irreversible cooperative processes on lattices, 8:12790 (R:US)
CRYSTALS
See also LIQUID CRYSTALS
MONOCRYSTALS
Moessbauer Effect
Radio-frequency resonance effect on diffraction of Moessbauer gamma quanta in a crystal, 8:12671 (RA:SU:In Russian)
Radiowave Radiation
Radio-frequency resonance effect on diffraction of Moessbauer gamma quanta in a crystal, 8:12671 (RA:SU:In Russian)
CS-R PROCESS
Comparative Evaluations
Comparative analysis of peat gasification reactor configurations, 8:11611 (RA:US)
Economic Analysis
Peat gasification: Rockwell international process, 8:11601 (RA:US)
Mathematical Models
Peat gasification: Rockwell international process, 8:11601 (RA:US)
CURIUM COMPOUNDS
Hydrolysis
Thermodynamic properties of chemical species in nuclear waste, 8:12825 (R:US)
CURRENT-DRIVE HEATING
Bernstein Mode
Radio-frequency wave trajectories for current drive in tokamak reactors, 8:13447 (R:US)
Efficiency
Radio-frequency wave trajectories for current drive in tokamak reactors, 8:13447 (R:US)
Hybrid Resonance
Radio-frequency wave trajectories for current drive in tokamak reactors, 8:13447 (R:US)
Ion Plasma Waves
Radio-frequency wave trajectories for current drive in tokamak reactors, 8:13447 (R:US)
CUTTING TOOLS
Grinding
Regrinding and relapping of single-point, single-crystal diamond turning and boring tools, 8:12856 (R:US)
Inspection
Regrinding and relapping of single-point, single-crystal diamond turning and boring tools, 8:12856 (R:US)
Surface Finishing
Regrinding and relapping of single-point, single-crystal diamond turning and boring tools, 8:12856 (R:US)
CYANINE DYES
Chemical Radiation Effects
Gamma and fast neutron dosimetry with leuko dye optical waveguides, 8:12977 (RA:US)
Personnel neutron dosimeter utilizing radiochromic dyes, 8:12976 (RA:US)
CYANOCOBALAMIN
See VITAMIN B-12
CYCLOALKENES
Dehydrogenation
Dehydrogenation processes on nickel and platinum surfaces. Conversion of cyclohexane, cyclohexene, and cyclohexadiene to benzene, 8:12810 (J:US)
Desorption
Dehydrogenation processes on nickel and platinum surfaces. Conversion of cyclohexane, cyclohexene, and cyclohexadiene to benzene, 8:12810 (J:US)
CYCLOHEXANE
Dehydrogenation
Dehydrogenation processes on nickel and platinum surfaces. Conversion of cyclohexane, cyclohexene, and cyclohexadiene to benzene, 8:12810 (J:US)
Desorption
Dehydrogenation processes on nickel and platinum surfaces. Conversion of cyclohexane, cyclohexene, and cyclohexadiene to benzene, 8:12810 (J:US)
CYCLOHEXIMIDE
Biological Effects
Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture, 8:13116 (J:US)
CYCLONE SEPARATORS
Design
Flow and design characteristics of the hydrocyclone for the recovery of coal fines. Fifth quarterly report, September 1, 1982-November 30, 1982, 8:11754 (R:US)
Economic Analysis
Study of hydrocyclone applications to separation processes for coal preparation. Final report, 8:11751 (R:US)
Mathematical Models
Study of hydrocyclone applications to separation processes for coal preparation. Final report, 8:11751 (R:US)
Performance
Study of hydrocyclone applications to separation processes for coal preparation. Final report, 8:11751 (R:US)
Performance Testing
Flow and design characteristics of the hydrocyclone for the recovery of coal fines. Fifth quarterly report, September 1, 1982-November 30, 1982, 8:11754 (R:US)
Scaling Laws
Flow and design characteristics of the hydrocyclone for the recovery of coal fines. Fifth quarterly report, September 1, 1982-November 30, 1982, 8:11754 (R:US)
CYCLOTRONS
See also ISOCHRONOUS CYCLOTRONS
VARIABLE ENERGY CYCLOTRONS
Cavity Resonators
Study on the supercyclotron cavity model excitation, 8:12920 (R:SU:In Russian)
Ion Sources
Study on laser plasma as a source of multicharged ions for cyclotrons in the light element range (Li,Be,C), 8:12922 (R:SU:In Russian)
Isotope Production
Design characteristics of a cyclotron for producing radioisotopes, 8:12827 (TG:DE:GE)
Specifications
Design characteristics of a cyclotron for producing radioisotopes, 8:12827 (TG:DE:GE)
CYLINDRICAL PARABOLIC COLLECTORS
See PARABOLIC TROUGH COLLECTORS
CYTOCHROMES
Raman Spectra
Protein influences on porphyrin structure in cytochrome c: evidence from Raman difference spectroscopy, 8:12812 (J:US)
Structural Chemical Analysis
Protein influences on porphyrin structure in cytochrome c: evidence from Raman difference spectroscopy, 8:12812 (J:US)

D

D RESONANCES
Cross Sections
Recent results from the MAC and MARK II detectors at PEP, 8:12932 (R:US)
DAPHNIA
Biological Radiation Effects
Application of a surplus production model to assess environmental impacts on exploited populations of Daphnia pulex in the laboratory, 8:13159 (J:GB)
DARK REPAIR
See BIOLOGICAL REPAIR

DARLINGTON-1 REACTOR
Reactor Shutdown
Report on the use of programmable digital computers in the shutdown systems of the Darlington G.S., 8:12400 (R:CA)
DATA ACQUISITION SYSTEMS
ND6600 computer in fusion-energy research, 8:13445 (R:US)
Computer Networks
DDCMP protocol on a DMA serial-line board, 8:13008 (R:US)
Equipment Interfaces
Fastbus software progress, 8:13566 (R:US)
I/O register to FASTBUS interface, 8:13564 (R:US)
Programming
Tools for developing software for different types of microprocessors, to be used, in particular, for the acquisition and processing of nuclear data, 8:13542 (R:FR:In French)
Specifications
Timing and control monitor system requirements: an overview, 8:13015 (R:US)
DATING
See AGE ESTIMATION
DBP
Radioactive Waste Processing
Removal of solubilized solvent extractants from aqueous waste streams, 8:11919 (J:JP)
DDG
See DISTILLERS DRIED GRAINS
DEBRIS (NUCLEAR)
See FISSION PRODUCTS
DEC COMPUTERS
Computers manufactured by Digital Equipment Corporation.
Computer Codes
VAXMATH: a mathematical software library for the VAX, 8:13553 (R:US)
DECALSO
See ION EXCHANGE MATERIALS
DECANE
Phase Studies
Liquid crystals and microemulsions in oil recovery, 8:11801 (J:US)
DECAY HEAT REMOVAL
See AFTER-HEAT REMOVAL
DECIDUOUS TREES
See TREES
DECIMETER WAVE RADIATION (1-3 DM)
See RADIOWAVE RADIATION
DECIMETER WAVE RADIATION (3-10DM)
See RADIOWAVE RADIATION
DECOMMISSIONING
See also REACTOR DECOMMISSIONING
Technology Assessment
Development of improved technology for decommissioning operations, 8:11903 (R:US)
DECONTAMINATION
Cost
Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents, 8:12413 (R:US)
Planning
Comprehensive (MORT based) approach to planning internal decontamination (PWR;BWR), 8:12418 (R:US)
DECONTAMINATION FACTOR
See DECONTAMINATION
DEFECTS
Not for CRYSTAL DEFECTS.
Images
Acoustic-emission linear-pulse holography, 8:12881 (R:US)
DEFORMED NUCLEI
Giant Resonance
Description of giant resonance decay in quasi particle-phonon model, 8:13337 (RA:SU:In Russian)
Photonuclear Reactions
Description of giant resonance decay in quasi particle-phonon model, 8:13337 (RA:SU:In Russian)
Quasiparticle-Phonon Model
Fragmentation of the few quasiparticle components in the deformed nuclei, 8:13338 (RA:SU:In Russian)
Taking into account the Pauli principle in description of odd deformed nuclei states, 8:13356 (RA:SU:In Russian)
DEHPA
See PHOSPHONIC ACID ESTERS
DEHUMIDIFIERS
Desiccants
Characterization of supersorbent polymers for dehumidification. Final report, 8:12569 (R:US)
Solar-regenerated desiccant dehumidification. Final report, 8:12170 (R:US)
Solar Regenerators
Solar-regenerated desiccant dehumidification. Final report, 8:12170 (R:US)
DELAWARE
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
DELTA RESONANCES (MESON)
See MESON RESONANCES
DELTA-1236 RESONANCES
Particle Production
Double Regge exchange in rho $\Delta\pi$ and rho rho N final states from π^- p interactions at 8 GeV/c, 8:13257 (R:US)
DEOXYCYTIDINURIA
See URINE
DEOXYPENTOSE NUCLEIC ACID
See DNA
DEOXYRIBONUCLEIC ACID
See DNA
DEPARTMENT OF INTERIOR
See US DOI
DEPLETION (ISOTOPIC)
See ISOTOPE SEPARATION
DEPOSITS (GEOLOGICAL)
See GEOLOGIC DEPOSITS
DESALINATION PLANTS
Safety
Reliability and system analysis of nuclear desalination plants based on operation experience, 8:12288 (D:US)
DESICCANTS
Mathematical Models
Micro-macropore model for sorption of water on silica gel in a dehumidifier, 8:12175 (J:GB)
DESOXYRIBONUCLEIC ACID
See DNA
DESTRUCTIVE TESTING
Dynamic Loads
Pressure-shear loading techniques for material-property studies, 8:12882 (R:US)
Test Facilities
Pressure-shear loading techniques for material-property studies, 8:12882 (R:US)
DESULFURIZATION
Computerized Simulation
Systems model of the iron oxide hot gas clean-up process. Volume II. Hotgas user's manual. Final report, September 1979-December 1980, 8:11661 (R:US)
DETECTION (NUCLEAR EXPLOSIONS)
See NUCLEAR EXPLOSION DETECTION
DETECTION (SEISMIC)
See SEISMIC DETECTION
DETECTORS (RADIATION)
See RADIATION DETECTORS
DETONATORS
Design
Arming and firing system for PRE-DIRECT COURSE, 8:13011 (R:US)
Performance
Arming and firing system for PRE-DIRECT COURSE, 8:13011 (R:US)
DEUTERIUM
Diffusion
Hydrogen and deuterium diffusion in vanadium alloys (Containing Ti or Nb), 8:12676 (R:US)
Isotope Effects
Isotope effects in the infrared spectra of the metal carbonyl hydride/deuteride anions (H/D)M(CO)$_4$P (M = Fe, Ru, or Os), 8:12798 (J:US)

Kinetics and mechanism of methanol decomposition over zinc oxide, 8:11982 (R:US)
DEUTERIUM IONS
Polarized Beams
Application of the electron-cyclotron resonance source to Lamb-shift polarized ion sources, 8:13235 (R:US)
DEUTERIUM TARGET
Deuteron Reactions
Algebraic version of resonating-group method and elastic scattering plases of the $^3He(n, n)^3He$, $^3H(p, p)^3H$, $^2H(d, d)^2H$, 8:13299 (RA:SU:In Russian)
DEUTERON REACTIONS
Coupled Channel Theory
Non-Born methods in the direct nuclear reaction theory, 8:13371 (RA:SU:In Russian)
Elastic Scattering
Algebraic version of resonating-group method and elastic scattering plases of the $^3He(n, n)^3He$, $^3H(p, p)^3H$, $^2H(d, d)^2H$, 8:13299 (RA:SU:In Russian)
DEUTERON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
DEUTERON REACTIONS
DEVELOPED COUNTRIES
Energy Demand
Worldwide nuclear power, 8:12476 (J:US)
Nuclear Power Plants
Worldwide nuclear power, 8:12476 (J:US)
DEVICES
See EQUIPMENT
DEVONIAN SHALES
See BLACK SHALES
DEXAMETHASONE
Biological Effects
Degradation of connective tissue matrices by macrophages. III. Morphological and biochemical studies on extracellular, pericellular, and intracellular events in matrix proteolysis by macrophages in culture, 8:13123 (J:US)
DEXTRONIC ACID
See GLUCONIC ACID
DIAPHORASE
Enzyme Activity
Histochemistry of NADH diaphorase and γ-glutamyltranspeptidase in rat bladder tumors, 8:13112 (J:US)
DIAPHORASES
See DIAPHORASE
DIAPHRAGMS (THERMONUCLEAR DEVICE)
See LIMITERS
DIBUTYL PHOSPHATE
See DBP
DIELECTRIC TRACK DETECTORS
Radon and radon-daughter exposure measurements by through-etched track registration in cellulose nitrate, 8:12944 (R:BR)
Uranium content of petroleum by fission track technique, 8:12761 (R:BR)
Calibration
Calibration of SSTR neutron dosimetry for TMI-2 applications, 8:12398 (R:US)
Comparative Evaluations
Evaluation of experiences in long-term radon and radon-daughter measurements, 8:13044 (R:US)
Efficiency
Studies of alpha particle registration in LR-115 type II. A solid state nuclear track detector, 8:12965 (R:BR)
Energy Dependence
Developments in solid state detectors for personnel neutron dosimetry, 8:12982 (RA:US)
Sensitivity
Developments in solid state detectors for personnel neutron dosimetry, 8:12982 (RA:US)
DIESEL ENGINES
Diesel Fuels
Cottonseed oil as a diesel-engine fuel. Final report, 8:12656 (R:US)
Cottonseed oil as a diesel-engine fuel. Part 2. Appendices. Final report, 8:12657 (R:US)
Efficiency
International outlook of Otto versus diesel cycle engine for operation on biomass fuels, 8:12652 (RA:BR)
Ethanol
Problems in adapting ethanol fuels to the requirements of diesel engines, 8:12644 (RA:BR)
Fuel Substitution
Alternative engine fuels: educational demonstration project. Final report, 8:12655 (R:US)
Brazilian biomass utilization program, with emphasis on proalcool, 8:12025 (RA:BR)
Cottonseed oil as a diesel-engine fuel. Final report, 8:12656 (R:US)
Cottonseed oil as a diesel-engine fuel. Part 2. Appendices. Final report, 8:12657 (R:US)
International outlook of Otto versus diesel cycle engine for operation on biomass fuels, 8:12652 (RA:BR)
Problems in adapting ethanol fuels to the requirements of diesel engines, 8:12644 (RA:BR)
Use of glow-plugs in order to obtain multifuel capability of diesel engines, 8:12654 (RA:BR)
Use vegetable oils in internal combustion engines, 8:12040 (RA:BR)
Ignition
Use of glow-plugs in order to obtain multifuel capability of diesel engines, 8:12654 (RA:BR)
Performance
Problems in adapting ethanol fuels to the requirements of diesel engines, 8:12644 (RA:BR)
Research Programs
Power supplies, 8:11737 (R:US)
DIESEL FUELS
Antiknock Ratings
Modified cetane scale for low-ignition-quality fuels, 8:11814 (B:US)
Chemical Analysis
Laser excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons, 8:12758 (R:US)
Classification
Modified cetane scale for low-ignition-quality fuels, 8:11814 (B:US)
Fuel Substitution
Technical considerations in choosing alcohol fuels for less-developed countries, 8:12041 (R:US)
Production
Oil refining flexibility and alternative fuels (Brazil), 8:11807 (RA:BR)
DIESEL OIL (FRACTION)
See DIESEL FUELS
DIFFERENTIAL EQUATIONS
See also NEUTRON DIFFUSION EQUATION
PARTIAL DIFFERENTIAL EQUATIONS
Numerical Solution
Report on progress and results obtained under contract No. AS05-76-ER03443 until October 31, 1980, 8:13544 (R:US)
DIFFRACTION (X-RAY)
See X-RAY DIFFRACTION
DIGITAL FILTERS
Algorithms
Non-recursive lowpass digital-filter algorithm, 8:13560 (R:US)
DIODES (SEMICONDUCTOR)
See SEMICONDUCTOR DIODES
DIPHENYL KETONE
See BENZOPHENONE
DIRAC MONOPOLES
See MAGNETIC MONOPOLES
DIRECT REACTIONS
Coupled Channel Theory
Non-Born methods in the direct nuclear reaction theory, 8:13371 (RA:SU:In Russian)
DISCHARGES (WASTES)
See WASTE DISPOSAL
DISINTEGRATION (FISSION)
See FISSION
DISPERSANTS (CHEMICAL)
See SURFACTANTS
DISPOSAL (WASTES)
See WASTE DISPOSAL

DISSOLUTION
See also LEACHING
Measuring Methods
Use of in vitro dissolution data when interpreting uranium bioassay data, 8:11930 (RA:US)
DISSOLVED MATERIALS
See SOLUTES
DISTILLATE FUEL
See HEATING OILS
DISTILLATE FUEL OIL
See HEATING OILS
DISTILLATION
Energy Efficiency
Low energy motor fuel grade alcohol distillation systems, 8:11968 (RA:BR)
DISTILLATION EQUIPMENT
Energy Efficiency
Low energy motor fuel grade alcohol distillation systems, 8:11968 (RA:BR)
Waste Heat Utilization
Distilling alcohol with waste automobile heat. Final report, 8:12617 (R:US)
DISTILLERS DRIED GRAINS
Marketing Research
Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Market survey and economic analysis, 8:11978 (R:US)
DISTRIBUTED COLLECTOR POWER PLANTS
Design
Shenandoah Solar Total-Energy Project, 8:12122 (R:US)
DISTRICT OF COLUMBIA
See WASHINGTON DC
DNA
Biological Radiation Effects
Comparative action spectra for pyrimidine dimer formation in Cloudman S91 mouse melanoma and EMT6 mouse mammary carcinoma cells, 8:13162 (J:GB)
Biological Repair
Differential responses of log and stationary phase human fibroblasts to inhibition of DNA repair by aphidicolin, 8:13169 (J:NL)
DNA damage and carcinogenesis, 8:13172 (BA:US)
DNA repair, aging, and cancer, 8:13174 (J:US)
Ligase-deficient yeast cells exhibit defective DNA rejoining and enhanced gamma ray sensitivity, 8:13160 (J:US)
Protease inhibitors neither damage DNA nor interfere with DNA repair or replication in human cells, 8:13113 (J:NL)
Conformational Changes
Z-DNA conformation of N-2-acetylaminofluorene modified poly(dG-dC).poly(dG-dC) determined by reactivity with anti cytidine antibodies and minimized potential energy calculations, 8:13193 (J:GB)
Delayed Radiation Effects
DNA damage and carcinogenesis, 8:13172 (BA:US)
Hybridization
Detection of changes in maize DNA at the shrunken locus due to the intervention of Ds elements, 8:13125 (J:US)
Molecular Weight
Cells of pea (Pisum sativum) that differentiate from G2 phase have extrachromosomal DNA, 8:13107 (J:US)
Structural Chemical Analysis
Alternative view of mammalian DNA sequence organization. I. Repetitive sequence interspersion in Syrian hamster DNA: a model system, 8:13114 (J:GB)
Alternative view of mammalian DNA sequence organization. II. Short repetitive sequences are organized into scrambled tandem clusters in Syrian hamster DNA, 8:13115 (J:GB)
DNA REPLICATION
Protease inhibitors neither damage DNA nor interfere with DNA repair or replication in human cells, 8:13113 (J:NL)
Autoradiography
Measurement of unscheduled synthesis by autoradiography, 8:13132 (BA:US)
Biological Radiation Effects
Measurement of unscheduled synthesis by autoradiography, 8:13132 (BA:US)
Biological Repair
Measurement of unscheduled synthesis by autoradiography, 8:13132 (BA:US)
Inhibition
Screening of mutagens by inhibition of DNA synthesis, 8:13191 (BA:US)
Molecular Biology
Cells of pea (Pisum sativum) that differentiate from G2 phase have extrachromosomal DNA, 8:13107 (J:US)
DOEL-1 REACTOR
Primary Coolant Circuits
Study of the corrosion products in the primary system of PWR plants as the source of radiation fields build-up, 8:12299 (R:BE)
DOEL-2 REACTOR
Primary Coolant Circuits
Study of the corrosion products in the primary system of PWR plants as the source of radiation fields build-up, 8:12299 (R:BE)
DOMESTIC CRUDE OIL ENTITLEMENTS PROGRAM
See ENTITLEMENTS PROGRAM
DORMITORIES
See RESIDENTIAL BUILDINGS
DOSE EQUIVALENTS
Calculation Methods
Feasible neutron dosimeter for stray neutron fields at PWRS, 8:12989 (RA:US)
DOSEMETERS
See also ALBEDO-NEUTRON DOSEMETERS
CHEMICAL DOSEMETERS
COLORIMETRIC DOSEMETERS
PHOTOGRAPHIC FILM DOSEMETERS
Health physics instruments: what are the current needs, 8:12994 (R:US)
Organic Polymers
Personnel neutron dosimeters based on organic polymers, 8:12978 (RA:US)
Performance Testing
Status of current neutron dosimeter performance analyses, 8:13395 (RA:US)
DOSIMETERS
See DOSEMETERS
DOSIMETRY
See also ALPHA DOSIMETRY
BETA DOSIMETRY
FILM DOSIMETRY
GAMMA DOSIMETRY
NEUTRON DOSIMETRY
PERSONNEL DOSIMETRY
THERMOLUMINESCENT DOSIMETRY
Dose Equivalents
Relationship of body doses and dose equivalent index in case of external gamma and X-radiation, 8:13384 (RA:DE:In German)
Research Programs
Biological and clinical dosimetry. Comprehensive eighteen-year report, July 1, 1964-June 30, 1982, 8:13380 (R:US)
DOUBLET 3 DEVICES
See DOUBLET REACTORS
DOUBLET REACTORS
Degassing
Initial wall conditioning in Doublet III, 8:13479 (R:US)
Impurities
Dynamic behaviour of intrinsic impurities in Doublet III discharges, 8:13506 (J:A.T)
Initial wall conditioning in Doublet III, 8:13479 (R:US)
Limiters
Graphite limiter and armor damage in Doublet III, 8:13476 (R:US)
Microwave Equipment
Mode converters used in the Doublet III ech microwave system, 8:13477 (R:US)
Shielding
Graphite limiter and armor damage in Doublet III, 8:13476 (R:US)

DOXORUBICIN
Mutagen Screening
Screening of mutagens by inhibition of DNA synthesis, 8:13191 (BA:US)
DRAGLINES
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
DRIFT CHAMBERS
Space Charge
Use of nitrogen laser for observation of space-charge effects in drift chambers, 8:12992 (R:US)
Trigger Circuits
Versatile secondary trigger for a multi-detector system, 8:12993 (R:US)
DRILL SHIPS
See SHIPS
DRILLING FLUIDS
Limited to materials used in well drilling.
Research Programs
Geothermal technology development program. Annual progress report, October 1980-September 1981, 8:12247 (R:US)
Rheology
Clay-based geothermal drilling fluids, 8:12249 (R:US)
DRILLING MUD
See DRILLING FLUIDS
DRILLING (ROCK)
See ROCK DRILLING
DRINKING WATER
Purification
Literature survey, 8:13085 (RA:US)
Methods of removing uranium from drinking water. I. A literature survey. II. Present municipal water treatment and potential removal methods, 8:13084 (R:US)
Present municipal water treatment and potential removal methods, 8:13086 (RA:US)
Radioactivity
Intake of ^{226}Ra by ingestion and its evaluation in a selected population group, 8:13095 (TJ:US)
DRY SCRUBBERS
Control Systems
Coyote FGC system: a status report on a spray dryer/baghouse combination, 8:11686 (RA:US)
Performance Testing
Coyote FGC system: a status report on a spray dryer/baghouse combination, 8:11686 (RA:US)
DRY STORAGE
Design
Conceptual design of monitored retrievable storage facilities, 8:11859 (J:US)
DRYERS
See also CLOTHES DRYERS
Fuel Substitution
Evaluation of a system utilizing biomass (straw) as fuel for crop drying and heating on the farm, 8:12064 (R:CA)
Refuse Derived Fuels
Urban waste as a potential energy source for brick plants, 8:12632 (R:US)
DRYERS, CLOTHES
See CLOTHES DRYERS
DRY-TYPE COOLING TOWERS
See COOLING TOWERS
DTO
See TRITIUM COMPOUNDS
DUAL-PURPOSE POWER PLANTS
Design
Reliability and system analysis of nuclear desalination plants based on operation experience, 8:12288 (D:US)
Economic Analysis
Load requirements for economical cogenerated energy facilities in Chicago. Energy Management Memorandum TM-82-8, 8:12638 (R:US)
Economics
CHP: planning, technology, costs; the application of combined heat and power in a medium-sized city, 8:12642 (TJ:GB)
Operation
Reliability and system analysis of nuclear desalination plants based on operation experience, 8:12288 (D:US)
Planning
CHP: planning, technology, costs; the application of combined heat and power in a medium-sized city, 8:12642 (TJ:GB)
Safety
Reliability and system analysis of nuclear desalination plants based on operation experience, 8:12288 (D:US)
DUBNA SYNCHROCYCLOTRON
Magnetic Fields
Magnetic field shaping for the JINR phasotron, 8:12902 (R:SU:In Russian)
DUCTS
Gamma Transport Theory
Streaming of 14-MeV neutrons through an iron duct: comparison of measured neutron and gamma-ray energy spectra with results calculated using the Monte Carlo code MCNP, 8:13492 (R:US)
Neutron Transport
Streaming of 14-MeV neutrons through an iron duct: comparison of measured neutron and gamma-ray energy spectra with results calculated using the Monte Carlo code MCNP, 8:13492 (R:US)
DYMAC SYSTEM
See NUCLEAR MATERIALS MANAGEMENT PLUTONIUM
DYNAMIC MATERIALS ACCOUNTABILITY SYSTEM
See NUCLEAR MATERIALS MANAGEMENT PLUTONIUM
DYSPROSIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
DYSPROSIUM BROMIDES
Crystal Structure
Investigations on the structure and polymorphy of the dibromides of dysprosium, thulium, ytterbium and calcium, 8:12781 (R:DE:In German)

E

EARTH ATMOSPHERE
See also STRATOSPHERE TROPOSPHERE
Light Transmission
Optimum exposure of solar collectors with respect to atmospheric transmission of solar radiation, 8:12006 (RA:CH)
EARTHQUAKES
Ground Motion
Damping in building structured during earthquakes: test data and modeling, 8:12854 (R:US)
Effects of earthquake-rupture shallowness and local soil conditions on simulated ground motions, 8:13212 (R:US)
EASTERN EUROPE
See also USSR
Coal Deposits
Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA:US)
Coal Mines
Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA:US)
Coal Reserves
Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA:US)
EBIS
See ELECTRON BEAM ION SOURCES
EBR-2 REACTOR
Steam Generators
Measurement of acoustic background noise on the EBR-II steam generators, 8:12378 (J:US)
ECONOMIC DEVELOPMENT
Energy Supplies
Desirable energy future: a national perspective (Book), 8:12490 (B:US)

ECR HEATING
Monte Carlo Method
Monte Carlo studies of tandem-mirror plasmas interacting with waves in the ion-cyclotron range of frequencies (ICRF). Progress report, October 1, 1982-December 31, 1982, 8:13422 (R:US)
Research Programs
Research report 1980, 8:13424 (R:DE:In German)
Research report 1979, 8:13429 (R:DE:In German)
EDS LIQUEFACTION
See EXXON LIQUEFACTION PROCESS
EDUCATIONAL FACILITIES
See also SCHOOL BUILDINGS
Photovoltaic Power Supplies
Intermediate photovoltaic system application experiment operational performance report. Volume 3. For Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma, 8:12116 (R:US)
Intermediate photovoltaic system application experiment operational performance report. Volume 6. For Oklahoma Center for Science and Arts, Oklahoma City, OK for October 1982, 8:12117 (R:US)
EFFLUENTS (GASEOUS)
See GASEOUS WASTES
EFFLUENTS (LIQUID)
See LIQUID WASTES
EFFLUENTS (RADIOACTIVE)
See RADIOACTIVE EFFLUENTS
EHF RADIATION
See MICROWAVE RADIATION
EINSTEIN GRAVITATION THEORY
See GENERAL RELATIVITY THEORY
ELECTRIC BATTERIES
Devices for production and/or storage of electrical energy from chemical reactions; excludes FUEL CELLS and RADIOISOTOPE BATTERIES.
See also LEAD-ACID BATTERIES
Electrolytes
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
Materials
New battery materials. Final report, April 1, 1977-Dec. 31, 1979, 8:12460 (R:US)
Performance
Analysis and comparison of automotive-propulsion systems, 8:12643 (R:US)
ELECTRIC CABLES
Damage
Nuclear power plant electrical cable damageability experiments, 8:12351 (R:US)
Performance Testing
Nuclear power plant electrical cable damageability experiments, 8:12351 (R:US)
ELECTRIC CONDENSERS
See CAPACITORS
ELECTRIC CONTACTS
Testing of sliding electrical contacts for homopolar generators, 8:13470 (R:US)
ELECTRIC FIELDS
Biological Effects
Biological effects of high-strength electric fields on small laboratory animals. Interim report, March 1, 1978-September 30, 1979, 8:13194 (R:US)
ELECTRIC GENERATORS
Rotating generators only; excludes DIRECT ENERGY CONVERTERS.
See also ALTERNATORS
Electric Contacts
Testing of sliding electrical contacts for homopolar generators, 8:13470 (R:US)
Meetings
Doubly fed machine review: agenda. Conference report, Washington, DC, 8:12263 (R:US)
Research Programs
Pulsed hompolar generator research at the University of Texas at Austin, 8:13469 (R:US)
ELECTRIC POWER
See also HYDROELECTRIC POWER
Energy resources in California, 8:12483 (R:US)
Cost
Commercial energy costs for SOLCOST Data Bank cities, winter 1981-1982, 8:12014 (R:US)
Conceptual integrated gasifier combined-cycle power-plant design. Final report, 8:11621 (R:US)
Generating capacity in US electric utilities: how is it used; how much is needed over the decade, 8:12505 (R:US)
Energy Policy
Study of aggregation alternatives in the US electric-utility industry, 8:12504 (R:US)
Prices
Methodology and results of the impacts of modeling electric utilities: a comparative evaluation of MEMM and REM, 8:12507 (R:US)
Theft
Energy diversion: theft of electricity, 8:12498 (R:US)
Legal remedies for theft of electricity, 8:12502 (R:US)
ELECTRIC POWER RESEARCH INSTITUTE
See EPRI
ELECTRIC POWER SYSTEMS
See POWER SYSTEMS
ELECTRIC UTILITIES
SCE resources in the 1980's, 8:12239 (RA:US)
Adversaries
Energy diversion: theft of electricity, 8:12498 (R:US)
Boiler Fuels
Application of the Toscoal process to the electric utility industry, 8:12269 (RA:US)
Decision Making
Study of aggregation alternatives in the US electric-utility industry, 8:12504 (R:US)
Fuel Substitution
Electric utilities and natural gas use, 8:12484 (R:US)
Fuel Supplies
Selected antitrust issues in utility fuels and equipment purchases, 8:12499 (R:US)
Joint Ventures
Adventures in joint ventures: issues facing attorneys and managers in joint-action power projects, 8:12503 (R:US)
Lawsuits
Legal remedies for theft of electricity, 8:12502 (R:US)
Legal Aspects
Some aspects of utility obligation to serve new retail loads, 8:12501 (R:US)
Management
Adventures in joint ventures: issues facing attorneys and managers in joint-action power projects, 8:12503 (R:US)
Manpower
Forecasts of on-site and off-site occupational requirements for energy-construction developments in the United States, 1982 to 2000, 8:12465 (R:US)
Operation
Some aspects of utility obligation to serve new retail loads, 8:12501 (R:US)
Photovoltaic Power Supplies
Intermediate photovoltaic system application experiment, July and August 1982 operational performance report. Volume 14. For Newman Power Station, El Paso, Texas, 8:12115 (R:US)
Planning
Study of aggregation alternatives in the US electric-utility industry, 8:12504 (R:US)
Power Demand
Generating capacity in US electric utilities: how is it used; how much is needed over the decade, 8:12505 (R:US)
Power Generation
Generating capacity in US electric utilities: how is it used; how much is needed over the decade, 8:12505 (R:US)
PURPA - small power production/cogeneration: implementing problems for the utility, 8:12500 (R:US)
Rate Structure
Alternatives of the industrial energy planner, 8:12616 (RA:US)
Commercial utility rate guide for SOLCOST Data Bank cities, 8:12635 (R:US)

Residential utility rate guide for SOLCOST data bank cities, 8:12636 (R:US)
Regional Analysis
Study of aggregation alternatives in the US electric-utility industry, 8:12504 (R:US)
Regulations
PURPA - small power production/cogeneration: implementing problems for the utility, 8:12500 (R:US)

ELECTRICAL EQUIPMENT
See also ANTENNAS
CAPACITORS
ELECTRIC CONTACTS
ELECTROMAGNETS
RESISTORS
Research Programs
Power supplies, 8:11737 (R:US)

ELECTRIC-POWERED VEHICLES
See also HYBRID ELECTRIC-POWERED VEHICLES
Demonstration Programs
EPRI/TVA pilot electric-vehicle demonstration: update 1980, 8:12649 (R:US)
Economic Impact
EPRI/TVA pilot electric-vehicle demonstration: update 1980, 8:12649 (R:US)
Iron-Nickel Batteries
Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment, 8:12459 (R:US)
Lead-Acid Batteries
Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment, 8:12459 (R:US)
Performance
Analysis and comparison of automotive-propulsion systems, 8:12643 (R:US)
Power Demand
EPRI/TVA pilot electric-vehicle demonstration: update 1980, 8:12649 (R:US)
Public Opinion
Consumer acceptance of electric vehicles, 8:12650 (R:US)
Road Tests
Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment, 8:12459 (R:US)
Zinc-Bromine Batteries
Design of bipolar, flowing-electrolyte zinc-bromine electric-vehicle-battery systems, 8:12651 (R:US)

ELECTROCHEMICAL CELLS
See also ELECTRIC BATTERIES
FUEL CELLS
PHOTOELECTROCHEMICAL CELLS
Thermochemical Processes
Electrochemistry applied to thermal conversion, 8:12092 (R:US)

ELECTRODES
Materials
Active electrodes to be used in advanced alkaline-water electrolysis, 8:11954 (R:BE)

ELECTROLYTIC CELLS
Electrochemistry
Behavior of Al electrodes in aqueous solutions, 8:12813 (R:NO)
Electrodes
Active electrodes to be used in advanced alkaline-water electrolysis, 8:11954 (R:BE)

ELECTROMAGNETIC PARTICLE DECAY
Report on results about weak and electroweak decays of hadrons and related phenomenological Lagrangians. Progress report, 8:13273 (R:US)

ELECTROMAGNETS
See also SUPERCONDUCTING MAGNETS
Radiation Hardening
Radiation-resistent magnets, 8:12914 (R:XC)

ELECTRON ACCEPTOR
See ELECTRONS

ELECTRON BEAM ION SOURCES
Ionization
Investigation of ionization efficiency in the "Krion-1" electron-beam source, 8:12923 (R:SU:In Russian)

ELECTRON BEAM WELDING
Electron-beam welding of aluminum alloys, 8:12704 (TJ:US)

ELECTRON BEAMS
Depth Dose Distributions
Microdosimetry of 0.5 to 2.0 MeV electron beams, 8:13392 (R:US)
Electric Fields
Structure of transition radiation of the electron bunch moving through plane screens, 8:13377 (R:SU:In Russian)
Hose Instability
Gaussian-profile beams, 8:12908 (R:US)
Microdosimetry
Microdosimetry of 0.5 to 2.0 MeV electron beams, 8:13392 (R:US)
Transition Radiation
Structure of transition radiation of the electron bunch moving through plane screens, 8:13377 (R:SU:In Russian)

ELECTRON COLLISIONS
See also ELECTRON-ATOM COLLISIONS
Meetings
Proceedings of 10. All-Union conference on physics of charged particles interaction with crystals. Part 2, 8:13238 (R:SU:RU)

ELECTRON COOLING
Irreversible Processes
Irreversible processes in a binary system of an electron cooling channel, 8:12900 (R:SU:In Russian)

ELECTRON CYCLOTRON MASERS
See MICROWAVE AMPLIFIERS

ELECTRON CYCLOTRON-RESONANCE HEATING
See ECR HEATING

ELECTRON DONOR
See ELECTRONS

ELECTRON MICROSCOPY
Uses
Use of analytical electron microscopy and auger electron spectroscopy for evaluating materials, 8:12760 (R:US)

ELECTRON REACTIONS
Breakup Reactions
Two-particle electro-disintegration of ^{3}He in a microscopic approach, 8:13301 (RA:SU:In Russian)
Elastic Scattering
Electromagnetic and weak scattering of electrons by the 1p shell nuclei and space parity violation, 8:13311 (RA:SU:In Russian)
Inelastic Scattering
Polarization phenomena in the $e^- + {}^6Li \rightarrow e^- + {}^6Li^*$ process, 8:13308 (RA:SU:In Russian)
P Invariance
Electromagnetic and weak scattering of electrons by the 1p shell nuclei and space parity violation, 8:13311 (RA:SU:In Russian)
Quasi-Elastic Scattering
Koltun sum rules testing in the (e, e'p) experiments on ^{3}He and ^{4}He, 8:13300 (RA:SU:In Russian)
Scattering
Covariant description of magnetic and electric properties of extended nuclei with half-integral spin in electronscattering, 8:13310 (RA:SU:In Russian)

ELECTRON-ATOM COLLISIONS
Meetings
Proceedings of the 2. Working Meeting on Radiation Interaction. Selected papers - part 1, 8:13242 (R:DD)

ELECTRONIC EQUIPMENT
Blowers
Discrete frequency noise and its reduction in small axial-flow fans. Technical memo, 8:12836 (R:US)
Cooling
Closed cycle cryocooler for low temperature electronic circuits. Phase II. Preliminary design. Final report 15 May-30 Sep 81, 8:12837 (R:US)
Maintenance
Study and organization of the maintenance of electronic equipment, 8:12838 (R:FR:In French)

Superconductors
Closed cycle cryocooler for low temperature electronic circuits. Phase II. Preliminary design. Final report 15 May-30 Sep 81, 8:12837 (R:US)

ELECTRON-POSITRON INTERACTIONS
Annihilation
Analysis of the energy weighted angular correlations in hadronic e^+e^- annihilations at 22 and 34 GeV, 8:13255 (R:DE)
Application of Gegenbauer integration method to e^+e^- annihilation process, 8:13270 (R:DE)
Search for charged scalar particles pair produced in e^+e^- annihilation, 8:13256 (R:DE)
Interference
Calculations of the interference of annihilation radiations with positron spectra in a Ge detector, 8:13000 (J:NL)
Pair Production
Topics in phenomenology of unified gauge theories of weak, electromagnetic, and strong interactions, 8:13289 (R:US)
Quantum Chromodynamics
Application of Gegenbauer integration method to e^+e^- annihilation process, 8:13270 (R:DE)

ELECTRON-RING ACCELERATORS
Magnetic Fields
Magnetic system of induction section for accelerating an electron-ion ring, 8:12903 (R:SU:In Russian)

ELECTRONS
Bremsstrahlung
Relativistic electron bremsstrahlung in the resonance electromagnetic field, 8:13240 (RA:SU:In Russian)

ELECTROSLAG CASTING
Cost
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)

ELECTROSTATIC ACCELERATORS
See also TANDEM ELECTROSTATIC ACCELERATORS
Beam Monitoring
Determination of energetic parameters of the beam of the EhGP-10-P charge-exchange electrostatic accelerator, 8:12928 (R:SU:In Russian)

ELECTROSTATIC LENSES
Electric Fields
Computation of the fields in structures with spatially-uniform quadrupole focusing for electrodes of special configuration, 8:12901 (R:SU:In Russian)

ELECTROSTATIC PRECIPITATORS
Energy Consumption
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)
Performance
Boiler efficiency and emissions testing using refuse-derived fuel (RDF) and coal, Wright-Patterson Air Force Base, Ohio 45433. Final report 21-26 Feb 82, 8:12892 (R:US)
Test Facilities
Configurational testing of electron-beam ionization for coal-fly-ash precipitators. Quarterly report No. 5, December 2, 1981-March 1, 1982, 8:11685 (R:US)

ELECTROSTATIC WAVES
See PLASMA WAVES

ELMO BUMPY TORUS
Microwave Amplifiers
Development program for a 200-kW, c-w gyrotron. Quarterly report No. 10, October-December 1981, 8:13489 (R:US)
Shielding
EBT-P gamma-ray shielding analysis, 8:13512 (J:US)
X-Ray Spectra
Communications interface for the PDP-11 and the Nuclear Data 6600, 8:13444 (R:US)
ND6600 computer in fusion-energy research, 8:13445 (R:US)

ELUTION (SOLUBLE CONSTITUENTS)
See LEACHING

EMERGENCIES
See ACCIDENTS

EMPLOYEES
See PERSONNEL

EMPLOYMENT
Forecasting
Forecasts of on-site and off-site occupational requirements for energy-construction developments in the United States, 1982 to 2000, 8:12465 (R:US)

END USE SECTOR
See COMMERCIAL SECTOR
INDUSTRY
RESIDENTIAL SECTOR
TRANSPORTATION SECTOR

ENERGY AUDITS
Evaluation
Overcoming barriers to residential conservation: do energy audits help, 8:12567 (R:US)

ENERGY CONSERVATION
Constraints
Barriers to household investment in residential energy conservation: preliminary assessment, 8:12566 (R:US)
Financing
Financing conservation and renewable energy in the eighties, 8:12548 (R:US)
Third-party financing: increasing investment in energy-efficient industrial projects, 8:12618 (R:US)
Government Policies
Assessment of energy conservation opportunities in state-assisted housing, 8:12478 (R:US)
Information Dissemination
A description and evaluation of the Jackson County Action to Save Energy Program. Final report, 8:12549 (R:US)
Research Programs
Program planning document for energy-conservation research, development, and demonstration in Texas. Final report, 8:12550 (R:US)
Texas Energy Development Fund. Project status reports, 8:11998 (R:US)

ENERGY CONSUMPTION
See also FUEL CONSUMPTION
Climate and energy, 8:12001 (RA:CH)
Forecasting
Harmonizatoin of data banks from energy model EFOM 12C with other Belgian data banks. Final report, 8:12461 (R:XE:FR)

ENERGY DEMAND
Computer Codes
SAMSS: computer-aid system for the preparation of social-science models. Reference and implementation instruction manual. Final report, 8:13097 (R:XE)
SAMSS: computer-aid system for the preparation of social-science models. Final report, 8:13098 (R:XE)
Forecasting
Documentation of initial activities in AGF long-term planning of R+D projects, 8:12479 (R:DE:In German)
SAMSS: computer-aid system for the preparation of social-science models. Reference and implementation instruction manual. Final report, 8:13097 (R:XE)
SAMSS: computer-aid system for the preparation of social-science models. Final report, 8:13098 (R:XE)

ENERGY EFFICIENCY STANDARDS
Regulations
Issues in federal preemption of state appliance energy-efficiency regulations, 8:12565 (R:US)

ENERGY EXPENSES
Economic Impact
Impact of energy pricing upon the Hispanic community, 8:12464 (R:US)

ENERGY MODELS
Technology assessment of solar energy systems. Scenario development and methodology. Volume II, 8:12019 (R:US)
Computerized Simulation
Maintenance of 12C software and adaptation to the data available at DG XVII and national planning offices. Final report, 8:12481 (R:XE)

ENERGY PERFORMANCE STANDARDS
See ENERGY EFFICIENCY STANDARDS

ENERGY POLICY
Desirable energy future: a national perspective (Book), 8:12490 (B:US)

Electric utilities and natural gas use, 8:12484 (R:US)
Energy, Texas, and the country, 8:12494 (RA:US)
Evaluation of policy options for increasing domestic oil inventories. Final report, 8:11789 (R:US)
Evaluation of policy options for increasing domestic oil inventories. Volume 2. Policies to increase petroleum inventories in the secondary and tertiary sectors. Final report, 8:11790 (R:US)
Synfuels and electricity from coal: DOE's refocus on R & D, 8:12486 (RA:US)
Synthetic Fuels Corporation progress to date with indications for the future, 8:12485 (RA:US)
Synthetic fuels: past performance and future plans, 8:12493 (RA:US)

Recommendations
Alternatives of the industrial energy planner, 8:12616 (RA:US)

ENERGY SECURITY CORPORATION
See SYNTHETIC FUELS CORPORATION

ENERGY SOURCE DEVELOPMENT

Constraints
Geothermal development on military lands: US Navy contract regulations from a developer's point of view, 8:12228 (RA:US)

Environmental Impacts
Community-Level Impacts Projection System (CLIPS). Final report, 8:12462 (R:US)
Comparing the health and environmental hazards of different energy systems, 8:13100 (R:US)

Financing
Feasibility analysis of a regional energy-development bank. Final report, 8:12463 (R:US)
Input-output and risk analysis for a regional energy-development bank. Final report, 8:12467 (R:US)

Health Hazards
Comparing the health and environmental hazards of different energy systems, 8:13100 (R:US)

Risk Assessment
Comparing the health and environmental hazards of different energy systems, 8:13100 (R:US)

Socio-Economic Factors
Community-Level Impacts Projection System (CLIPS). Final report, 8:12462 (R:US)
Socioeconomic issues associated with the use of peat as an energy resource, 8:11689 (RA:US)

ENERGY STORAGE
See also COMPRESSED AIR ENERGY STORAGE

Design
TEXT energy-storage system, 8:13464 (R:US)

Research Programs
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)

ENERGY STORAGE SYSTEMS

Capacitors
Parametric investigations and other related studies of energy storage type capacitors. Quarterly report, 8:12451 (R:US)

ENERGY SUPPLIES
See also FUEL SUPPLIES

Emergency Plans
Report to the Congress: comprehensive energy - emergency response procedures, 8:11810 (R:US)

Energy Policy
Desirable energy future: a national perspective (Book), 8:12490 (B:US)

Forecasting
Desirable energy future: a national perspective (Book), 8:12490 (B:US)

Global Aspects
Biomass: its utilization as food and/or fuel, 8:12027 (RA:BR)

Mathematical Models
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)

Prices
Impact of energy pricing upon the Hispanic community, 8:12464 (R:US)

ENERGY TRANSMISSION
See ENERGY TRANSPORT

ENERGY TRANSPORT

Meteorology
Meteorological aspects of the transport of energy, 8:12477 (RA:CH)

ENEWETAK
See ENIWETOK

ENGINEERING TEST FACILITY (TOKAMAK)
See TOKAMAK ETF

ENGLAND
See UNITED KINGDOM

ENHANCED RECOVERY
See also MICROBIAL EOR

Environmental Impacts
Enhanced oil recovery: environmental issues and state regulatory programs, 8:13063 (J:GB)

Meetings
SPE/DOE symposium on enhanced oil recovery. Proceedings supplement, 8:11792 (R:US)

ENIWETOK

Contamination
Enewetak fact book (a resume of pre-cleanup information), 8:13013 (R:US)

Radiation Doses
β and γ-comparative dose estimates on Enewetak Atoll, 8:13400 (J:GB)

Site Surveys
Enewetak fact book (a resume of pre-cleanup information), 8:13013 (R:US)

ENRICHMENT (ISOTOPIC)
See ISOTOPE SEPARATION

ENTITLEMENTS PROGRAM
Analytical history of the entitlements program: entitlement notices, January 1978-December 1980, 8:11813 (R:US)
Analytical history of the entitlements program. Entitlement notices, November 1974-December 1977, 8:11812 (R:US)
Analytical history of the entitlements program, 8:11811 (R:US)

ENTOMOLOGY
See INSECTS

ENVIRONMENT

Quality Assurance
Approach to E, S, and H assurance programs for institutions. Volume II. Line-organization functions, 8:12469 (R:US)

ENVIRONMENTAL IMPACT STATEMENTS

Data Acquisition
Environmental data requirements and analysis for development of peat program, 8:11688 (RA:US)

Planning
Environmental data requirements and analysis for development of peat program, 8:11688 (RA:US)

ENVIRONMENTAL POLICY

Implementation
Approach to E, S, and H assurance programs for institutions. Volume II. Line-organization functions, 8:12469 (R:US)

ENVIRONMENTAL PROTECTION AGENCY
See US EPA

ENVIRONMENTAL TEMPERATURE
See AMBIENT TEMPERATURE

ENVIRONMENTAL TRANSPORT
See also RADIONUCLIDE MIGRATION

Mathematical Models
Potential role of biotic transport models in low-level-waste management, 8:11901 (R:US)
Validation of the atmospheric transport model: comparison of observed krypton-85 concentrations with those computed using a Gaussian plume model, 8:13048 (J:US)

Research Programs
Contaminant migration and fate research at Pacific Northwest Laboratory, 8:13045 (R:US)

ENZYME INHIBITORS

Biological Effects
Control of proton efflux from corn root tissue by an injury-sensing mechanism, 8:13121 (J:NL)
Degradation of connective tissue matrices by macrophages. III. Morphological and biochemical studies on extracellular, pericellular, and intracellular events in matrix proteolysis by macrophages in culture, 8:13123 (J:US)

Radiosensitivity Effects
Differential responses of log and stationary phase human fibroblasts to inhibition of DNA repair by aphidicolin, 8:13169 (J:NL)

EOR
See ENHANCED RECOVERY

EOSIN
Fluorescence
Dynamic aspects of the dye-sensitized photoconductivity of semiconductors. Technical progress report, April 1, 1981-March 31, 1983, 8:12733 (R:US)

EPA
See US EPA

EPITHELIUM
Biological Radiation Effects
Dose to basal cells in bronchial epithelium from long-lived alpha emitters in uranium mines, 8:13171 (BA:US)

EPRI
Research Programs
Ensuring power-system stability, 8:12286 (J:US)

EQUATIONS (DIFFERENTIAL)
See DIFFERENTIAL EQUATIONS

EQUIPMENT
Use of a more specific term is recommended.
See also DISTILLATION EQUIPMENT
ELECTRICAL EQUIPMENT
ELECTRONIC EQUIPMENT
FARM EQUIPMENT
HEAT RECOVERY EQUIPMENT
MAGNETIC ENERGY STORAGE EQUIPMENT
MATERIALS HANDLING EQUIPMENT
MILITARY EQUIPMENT
MINING EQUIPMENT
PARTICLE SIZE CLASSIFIERS
REMOTE VIEWING EQUIPMENT
SCRAPERS
THERMAL ENERGY STORAGE EQUIPMENT
WELL LOGGING EQUIPMENT
Availability
Guidebook for reliability, availability, and maintainability analysis of NWTS repository equipment. Volume II. Appendices (NWTS repository equipment), 8:11896 (R:US)
Maintenance
Guidebook for reliability, availability, and maintainability analysis of NWTS repository equipment. Volume II. Appendices (NWTS repository equipment), 8:11896 (R:US)
Reliability
Guidebook for reliability, availability, and maintainability analysis of NWTS repository equipment. Volume II. Appendices (NWTS repository equipment), 8:11896 (R:US)

EQUIPMENT INTERFACES
Communications interface for the PDP-11 and the Nuclear Data 6600, 8:13444 (R:US)

ERBIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

ERBIUM 156
Rotational States
Possible interpretation of the negative parity quasi- rotational band structure of ^{156}Er, 8:13340 (RA:SU:In Russian)

ERBIUM BORIDES
Magnetic Properties
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)
Superconductivity
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)

ERGONOMICS
See HUMAN FACTORS ENGINEERING

ESCHERICHIA COLI
Biological Radiation Effects
Nonreciprocal synergistic lethal interaction between 365-nm and 405-nm radiation in wild type and uvrA strains of Escherichia coli, 8:13164 (J:GB)
Genetic Radiation Effects
Effect of mutations in the uthetarD cistron of Escherichia coli on repair resynthesis, 8:13168 (J:NL)

ESTUARIES
Radionuclide Migration
Mathematical simulation of sediment and radionuclide transport in estuaries, 8:13089 (R:US)

ESTUARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS

ETA MESONS
Pair Production
Consideration of a measurement of absolute value eta $_{00}$ ^{2}/absolute value eta/sub +-/^{2} at LAMPF II, 8:13264 (R:US)
Particle Production
Search for new heavy techniparticles, 8:13268 (R:US)

ETA-549
See ETA MESONS

ETF (TOKAMAK)
See TOKAMAK ETF

ETHANOL
Adsorption
Adsorption of ethanol and water vapor by Silicalite, a hydrophobic molecular sieve, 8:12061 (R:US)
Biological Adaptation
Development of high alcohol tolerant organisms. I. Strain selection and screening. Annual report, 31 July 1981-1 August 1982, 8:11973 (R:US)
Biosynthesis
Conversion of cellulose to ethanol by mesophilic bacteria. Progress report and third year budget, 8:11971 (R:US)
Development of high alcohol tolerant organisms. I. Strain selection and screening. Annual report, 31 July 1981-1 August 1982, 8:11973 (R:US)
Combustion Properties
Problems in adapting ethanol fuels to the requirements of diesel engines, 8:12644 (RA:BR)
Cost
Problems in adapting ethanol fuels to the requirements of diesel engines, 8:12644 (RA:BR)
Design
Technical/commercial feasibility study of the production of fuel-grade ethanol from corn: 100-million gallon-per-year production facility in Myrtle Grove, Louisiana, 8:12048 (R:US)
Distillation
Low energy motor fuel grade alcohol distillation systems, 8:11968 (RA:BR)
Environmental Impacts
Environmental impacts of energy utilization, 8:12468 (R:BR:In Portuguese)
Equipment
Technical/commercial feasibility study of the production of fuel-grade ethanol from corn: 100-million gallon-per-year production facility in Myrtle Grove, Louisiana, 8:12048 (R:US)
Fuel Additives
Problems in adapting ethanol fuels to the requirements of diesel engines, 8:12644 (RA:BR)
Market
Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 1. Appendices. Executive overview (Alabama), 8:11976 (R:US)
Marketing Research
Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Market survey and economic analysis, 8:11978 (R:US)
Production
Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 2. Technical concept (Alabama), 8:11977 (R:US)
Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 1. Appendices. Executive overview (Alabama), 8:11976 (R:US)
Microwaves and the industrial production of ethanol, 8:12036 (RA:BR)
Specifications
Technical/commercial feasibility study of the production of fuel-grade ethanol from corn: 100-million gallon-per-year

production facility in Myrtle Grove, Louisiana, 8:12048 (R:US)

Tolerance

Development of high alcohol tolerant organisms. I. Strain selection and screening. Annual report, 31 July 1981-1 August 1982, 8:11973 (R:US)

ETHANOL FUELS

Use for pure ethanol, ethanol-water mixtures, or ethanol with additives; for ethanol-gasoline mixtures, use GASOHOL.

Market

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Appendices. Market survey and economic analysis, 8:11979 (R:US)

Production

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Appendices. Market survey and economic analysis, 8:11979 (R:US)

Feasibility study of a 40-MGY/80-MGY fuel alcohol production plant. Equipment data: vendor correspondence and catalog cuts, 8:11974 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 1. Executive overview, 8:11975 (R:US)

Transport

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Appendices. Market survey and economic analysis, 8:11979 (R:US)

ETHANOL PLANTS

Control

Microbiological control of ethanol fermentation in industrial scale, 8:12037 (RA:BR)

Cost

Feasibility study for alternative-fuels production in Lincoln, Nebraska, 8:12055 (R:US)

Design

Analysis of five on-farm ethanol units in the United States, 8:12033 (RA:BR)

Ethanol production in small- to medium-size facilities. Final report, 8:12103 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 2. Technical concept (Alabama), 8:11977 (R:US)

Feasibility study for alternative-fuels production in Lincoln, Nebraska, 8:12055 (R:US)

Microplants for ethyl alcohol production, 8:12039 (RA:BR)

Economic Analysis

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Appendices. Market survey and economic analysis, 8:11979 (R:US)

Feasibility study of a 40-MGY/80-MGY fuel alcohol production plant. Equipment data: vendor correspondence and catalog cuts, 8:11974 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 1. Appendices. Executive overview (Alabama), 8:11976 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 1. Executive overview, 8:11975 (R:US)

Environmental Impacts

Alcohols from biomass: state-of-knowledge survey of environmental, health and safety aspects, 8:12045 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 4. Environmental, health, safety, and socioeconomic assessment, 8:11980 (R:US)

Feasibility study for a 1-MM-gal/y fuel-grade ethanol facility, 8:12053 (R:US)

Equipment

Feasibility study of a 40-MGY/80-MGY fuel alcohol production plant. Equipment data: vendor correspondence and catalog cuts, 8:11974 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 2. Technical concept (Alabama), 8:11977 (R:US)

Feasibility Studies

Demo plant for the production of fermentation ethanol for the motor fuel market in Sweden, 8:12030 (RA:BR)

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Appendices. Market survey and economic analysis, 8:11979 (R:US)

Feasibility study of a 40-MGY/80-MGY fuel alcohol production plant. Equipment data: vendor correspondence and catalog cuts, 8:11974 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 2. Technical concept (Alabama), 8:11977 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 1. Appendices. Executive overview (Alabama), 8:11976 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 4. Environmental, health, safety, and socioeconomic assessment, 8:11980 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Market survey and economic analysis, 8:11978 (R:US)

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 1. Executive overview, 8:11975 (R:US)

Heber Known Geothermal Resources Area ethanol-fuel facility. Final technical report, 8:12056 (R:US)

Geothermal Process Heat

Heber Known Geothermal Resources Area ethanol-fuel facility. Final technical report, 8:12056 (R:US)

Health Hazards

Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 4. Environmental, health, safety, and socioeconomic assessment, 8:11980 (R:US)

Operation

Analysis of five on-farm ethanol units in the United States, 8:12033 (RA:BR)

Site Selection

Feasibility study for a 1-MM-gal/y fuel-grade ethanol facility, 8:12053 (R:US)

Testing

Ethanol production in small- to medium-size facilities. Final report, 8:12103 (R:US)

Yields

Analysis of possible yield improvement in the industrial processing of sugarcane to alcohol, 8:12038 (RA:BR)

ETHINE

See ACETYLENE

ETHNIC GROUPS

See MINORITY GROUPS

ETHOCEL

See CELLULOSE

ETHYL ALCOHOL

See ETHANOL

ETHYLENE POLYMERS

See POLYETHYLENES

ETHYNE

See ACETYLENE

EUROPE

See also EASTERN EUROPE

Coal Deposits

Lignite in Europe: use, present and future production, 8:11735 (RA:US)

Coal Reserves

Lignite in Europe: use, present and future production, 8:11735 (RA:US)

EUROPEAN COMMUNITIES

See also COMMON MARKET

Chemical Plants

Reliability studies applied to plant safety, 8:12884 (TJ:GB)

Energy Models

Maintenance of 12C software and adaptation to the data available at DG XVII and national planning offices. Final report, 8:12481 (R:XE)

Nuclear Power Plants

Radioactive effluents from nuclear power stations in the European Community, 1974-1978, 8:12368 (J:US)

EUROPEAN ECONOMIC COMMUNITY

See COMMON MARKET

EUROPIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
EUROPIUM 147
Energy Levels
Properties of the ^{147}Eu and ^{149}Eu low-lying excited states in the framework of the semimicroscopic quasiparticle-phonon model, 8:13325 (RA:SU:In Russian)
EUROPIUM 149
Energy Levels
Properties of the ^{147}Eu and ^{149}Eu low-lying excited states in the framework of the semimicroscopic quasiparticle-phonon model, 8:13325 (RA:SU:In Russian)
EUROPIUM 153
Energy Levels
Calculation of parameters of non-adiabatic rotational model for the sup(153,155,157,159)Eu, 8:13336 (RA:SU:In Russian)
EUROPIUM 155
Energy Levels
Calculation of parameters of non-adiabatic rotational model for the sup(153,155,157,159)Eu, 8:13336 (RA:SU:In Russian)
EUROPIUM 157
Energy Levels
Calculation of parameters of non-adiabatic rotational model for the sup(153,155,157,159)Eu, 8:13336 (RA:SU:In Russian)
EUROPIUM 159
Energy Levels
Calculation of parameters of non-adiabatic rotational model for the sup(153,155,157,159)Eu, 8:13336 (RA:SU:In Russian)
EUROPIUM OXIDES
Electronic Structure
Luminescence studies of lanthanide oxides. I. Thermal and hydration effects on the metal ion site symmetry in europium oxide catalysts, 8:12794 (J:US)
Luminescence
Luminescence studies of lanthanide oxides. I. Thermal and hydration effects on the metal ion site symmetry in europium oxide catalysts, 8:12794 (J:US)
EVACUATED TUBE COLLECTORS
Antireflection Coatings
Evaluation of solar selective coating stability. Final report, September 1, 1978-May 31, 1980, 8:12178 (R:US)
Performance
Evaluation of SUNPACK tube vacuum quality. Final report, 1 September 1978-31 May 1980, 8:12177 (R:US)
Spectrally Selective Surfaces
Evaluation of solar selective coating stability. Final report, September 1, 1978-May 31, 1980, 8:12178 (R:US)
EVAPORATION
Heat Transfer
Determination of local heat transfer during falling-film evaporation and condensation on fluted surfaces for the purpose of designing high-efficiency evaporators, 8:12875 (TG:US)
EVAPORATORS
Design
Determination of local heat transfer during falling-film evaporation and condensation on fluted surfaces for the purpose of designing high-efficiency evaporators, 8:12875 (TG:US)
Efficiency
Determination of local heat transfer during falling-film evaporation and condensation on fluted surfaces for the purpose of designing high-efficiency evaporators, 8:12875 (TG:US)
EVEN-EVEN NUCLEI
Even protons, even neutrons.
See also BARIUM 142
BARIUM 146
BARIUM 148
BERYLLIUM 6
CADMIUM 112
CALCIUM 40
CALIFORNIUM 252
CERIUM 148
ERBIUM 156
HELIUM 6
LEAD 208
LEAD 210
MAGNESIUM 24
MOLYBDENUM 92
NICKEL 58
OXYGEN 16
PLUTONIUM 234
PLUTONIUM 238
PLUTONIUM 240
RADIUM 226
RADON 222
RADON 226
SILICON 28
STRONTIUM 82
STRONTIUM 90
TELLURIUM 124
THORIUM 232
TITANIUM 44
TITANIUM 50
TUNGSTEN 180
URANIUM 238
ZIRCONIUM 90
Interacting Boson Model
Taking into account proton-neutron symmetry in the framework of interacting boson model, 8:13367 (RA:SU:In Russian)
EVOLUTION
See BIOLOGICAL EVOLUTION
EXCAVATION
Technology Assessment
Suction trenching, and the use of fly ash for backfilling, 8:11822 (TJ:GB)
EXCISION REPAIR
See BIOLOGICAL REPAIR
EXCRETION ANALYSIS
See PERSONNEL MONITORING
EXPERIMENT PLANNING
Experimental design and data analysis, 8:13536 (R:US)
Wet oxidation of peat, 8:11667 (RA:US)
EXPERIMENTAL BREEDER REACTOR-2
See EBR-2 REACTOR
EXPERIMENTAL FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
EXPLOSIVE FRACTURING
Mathematical Models
Engineering model for predicting rubble motion during blasting, 8:13220 (R:US)
EXPOSURE (RADIATION DOSES)
See RADIATION DOSES
EXPOSURE RATEMETERS
Performance Testing
Mini-instruments environmental monitor Type 5.10G. Instrument evaluation no. 21, 8:12975 (R:GB)
EXTREMELY HIGH FREQUENCY RADIATION
See MICROWAVE RADIATION
EXXON DONOR SOLVENT LIQUEFACTION
See EXXON LIQUEFACTION PROCESS
EXXON GASIFICATION PROCESS
Engineering
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
EXXON LIQUEFACTION PROCESS
Air Pollution
EDS coal liquefaction process development. Phase V. ECLP industrial hygiene program. Interim report, 8:11599 (R:US)
Coking
Exxon donor solvent coal liquefaction process: ECLP operating experience II, 8:11592 (RA:US)
Industrial Medicine
EDS coal liquefaction process development. Phase V. ECLP industrial hygiene program. Interim report, 8:11599 (R:US)
Pilot Plants
EDS coal liquefaction process development. Phase V. ECLP industrial hygiene program. Interim report, 8:11599 (R:US)
Exxon donor solvent coal liquefaction process: ECLP operating experience II, 8:11592 (RA:US)
Pumps
Exxon donor solvent coal liquefaction process: ECLP operating experience II, 8:11592 (RA:US)
Residues
Exxon donor solvent coal liquefaction process: ECLP operating experience II, 8:11592 (RA:US)

Valves
Exxon donor solvent coal liquefaction process: ECLP operating experience II, 8:11592 (RA:US)

EYES
See also CORNEA
Anatomy
LENS* 4: a program for calculation of geometric optics of the human eye, 8:13136 (R:US)
Sensitivity
Induction of ocular neoplasms in Fischer rats by intraocular injection of nickel subsulfide, 8:13185 (J:US)

F

FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
FACILITIES (EDUCATIONAL)
See EDUCATIONAL FACILITIES
FACILITIES (MILITARY)
See MILITARY FACILITIES
FACILITIES (NUCLEAR)
See NUCLEAR FACILITIES
FACILITIES (RESOURCE RECOVERY)
See RESOURCE RECOVERY FACILITIES
FACILITIES (STORAGE)
See STORAGE FACILITIES
FACILITIES (TEST)
See TEST FACILITIES
FAILURES
See also RUPTURES
Probability
Incorporation of various uncertainties in dependent failure probability estimation, 8:12433 (J:US)
FALLOUT
For radioactive fallout only.
Radiation Monitoring
Interpretation of low-level environmental radioactivity measurements, 8:13038 (R:US)
FALLOUT PARTICULATES
See FALLOUT
FANS
See BLOWERS
FARADAY GENERATORS
See MHD GENERATORS
FARM EQUIPMENT
Diesel Engines
Alternative engine fuels: educational demonstration project. Final report, 8:12655 (R:US)
Cottonseed oil as a diesel-engine fuel. Final report, 8:12656 (R:US)
Cottonseed oil as a diesel-engine fuel. Part 2. Appendices. Final report, 8:12657 (R:US)
Spark Ignition Engines
Alternative engine fuels: educational demonstration project. Final report, 8:12655 (R:US)
FARMS
Total Energy Systems
Demonstration of biomass-derived fuels for integrated energy farm, 8:12100 (R:US)
FAST BREEDER TYPE REACTORS
See FBR TYPE REACTORS
FAST FLUX TEST FACILITY REACTOR
See FFTF REACTOR
FAST-MIXED SPECTRUM REACTOR
See FBR TYPE REACTORS
FATTY ACIDS
See CARBOXYLIC ACIDS
FAULT TREE ANALYSIS
Computer Codes
Quantitative fault tree analysis using the Set Evaluation Program (SEP), 8:13557 (R:US)
FAULT TREE SYSTEMS
See FAULT TREE ANALYSIS
FBR TYPE REACTORS
See also GCFR TYPE REACTORS
LMFBR TYPE REACTORS
Reactor Noise
Third Specialists Meeting on Reactor Noise, 8:12344 (J:US)
F-CHART
Evaluation
Uses and abuses of f-chart, 8:12146 (RA:US)
FDR REACTOR
See OTTO HAHN REACTOR
FEDERAL REGION X
Prior to June 1982 this concept was indexed to PACIFIC NORTHWEST REGION.
See also ALASKA
IDAHO
OREGON
WASHINGTON
Power Demand
Bonneville Power Administration and Rural Electrification Administration actions and activities affecting utility participation in Washington Public Power Supply System Plants 4 and 5, 8:12506 (R:US)
FEDERAL REPUBLIC OF GERMANY
Cogeneration
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
Energy Demand
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
Reactor Licensing
Reactor licensing in the United States and Federal Republic of Germany, 8:12323 (R:BR:In Portuguese)
Synthetic Fuels Industry
Synthetic fuels industry in Germany 1927 to 1945, 8:11778 (RA:US)
FEED MATERIALS PLANTS
Occupational Safety
Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982, 8:11928 (R:US)
Radiation Monitoring
Pitfalls in air sampling for radioactive particulates, 8:13049 (BA:US)
Radioactive Effluents
Use of air sampling data from uranium mills to estimate respiratory tract deposition rates for inhaled yellowcake, 8:11929 (RA:US)
FELDSPARS
See also ALBITE
Radiothermoluminescence
Thermoluminescence of the mineral components in granite, 8:13216 (R:US)
Thermoluminescence
Thermoluminescence of the mineral components in granite, 8:13216 (R:US)
FERMENTATION ALCOHOL
See ETHANOL
FERMILAB ACCELERATOR
Facility at Fermi National Accelerator Laboratory, Batavia, Illinois, includes main synchroton, booster synchrotron, and linac.
Accelerator Facilities
Annual progress report for the high-energy-physics program at Texas A and M University, December 1, 1981-December 1, 1982, 8:12947 (R:US)
Materials Handling Equipment
Structural analysis of the CDF transporter cart, 8:12917 (R:US)
Stochastic Cooling
Antiproton production and accumulation for a 20-TeV anti pp collider, 8:12907 (R:US)
FERMIONS
Mass
Neutrino mixing in grand unified models, 8:13271 (R:US)
FERRIC COMPOUNDS
See IRON COMPOUNDS

FERRITE GARNETS
Phase Transformations
Moessbauer studies of orientational transitions in substituted ferrite garnets, 8:12782 (RA:SU:In Russian)
FERROUS COMPOUNDS
See IRON COMPOUNDS
FERTILIZERS
Mixing
Particle-size requirements for bulk blend materials. Circular Z-146, 8:12746 (R:US)
Technology Assessment
Situation 82. Bulletin Y-174, 8:13139 (R:US)
FFTF REACTOR
Fuel Pellets
Improved specifications for fast reactor fuel, 8:12370 (R:US)
Fuel Pins
Improved specifications for fast reactor fuel, 8:12370 (R:US)
FIBERGLASS
Welded Joints
Operations manual: fiber-optics welder, 8:12846 (R:US)
FIBERS
Length
Problems and solutions in using short fiber reinforcements, 8:12721 (BA:US)
FIBRINOLYSIN
Code number 3.4.21.7.
Biological Effects
Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture, 8:13116 (J:US)
FIBROBLASTS
Biological Radiation Effects
Differential responses of log and stationary phase human fibroblasts to inhibition of DNA repair by aphidicolin, 8:13161 (J:NL)
FIELD THEORIES
See also GENERAL RELATIVITY THEORY
Convex Manifolds
Convexity of the effective potential, 8:13287 (R:US)
FIELDS (ELECTRIC)
See ELECTRIC FIELDS
FIELDS (MAGNETIC)
See MAGNETIC FIELDS
FILM BADGES
See PHOTOGRAPHIC FILM DOSEMETERS
FILM BOILING
Stability
Destabilization of Leidenfrost boiling by a sudden rise of ambient pressure, 8:12345 (J:GB)
FILM CONDENSATION
Heat Transfer
Determination of local heat transfer during falling-film evaporation and condensation on fluted surfaces for the purpose of designing high-efficiency evaporators, 8:12875 (TG:US)
FILM DOSEMETERS
See PHOTOGRAPHIC FILM DOSEMETERS
FILM DOSIMETRY
Data Processing
Computer-aided dose determination and methods of occupational dose analysis using film, 8:13389 (RA:DE:In German)
FILTERS
Performance
Survey of HEPA filter experience, 8:13046 (R:US)
FINITE DIFFERENCE METHOD
Comparative Evaluations
Comments on a recent paper by Emery et al.: a comparison of some of the thermal characteristics of finite-element and finite-difference calculations of transient problems, 8:13418 (J:US)
FINITE ELEMENT METHOD
Report on progress and results obtained under contract No. AS05-76-ER03443 until October 31, 1980, 8:13544 (R:US)
Comparative Evaluations
Comments on a recent paper by Emery et al.: a comparison of some of the thermal characteristics of finite-element and finite-difference calculations of transient problems, 8:13418 (J:US)
Nonlinear Problems
Nonlinear nonstationary analysis with the finite element method, 8:13416 (R:DE:In German)
Programming
Library of Modulef subroutines, 8:13556 (R:BR:In Portuguese)
FIRE STATIONS
See PUBLIC BUILDINGS
FIREDAMP
See METHANE
FIREHOSE INSTABILITY
See HOSE INSTABILITY
FIREWOOD
See WOOD FUELS
FIRST WALL
Research on the HYLIFE liquid-first-wall concept for future laser-fusion reactors: liquid jet impact experiments. Final report No. 8, 8:13496 (R:US)
Degassing
Initial wall conditioning in Doublet III, 8:13479 (R:US)
FISCHER-TROPSCH SYNTHESIS
Catalysts
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R:US)
Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982, 8:11645 (R:US)
Synthetic fuels industry in Germany 1927 to 1945, 8:11778 (RA:US)
Chemical Reaction Kinetics
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
Reaction Intermediates
Preparation and characterization of ligand types intermediate in the metal catalyzed conversion of coal to methane, methanol, and higher alkanes and alcohols. Final progress report, September 1, 1978-June 30, 1982, 8:11598 (R:US)
FISHES
Biological Radiation Effects
Application of a surplus production model to assess environmental impacts on exploited populations of Daphnia pulex in the laboratory, 8:13159 (J:GB)
Chemical Analysis
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Feeding
Feeding selectivity of schools of northern anchovy, Engraulis mordax, in the Southern California Bight, 8:13078 (J:US)
Migration
Introduction to modeling fish migratory behavior, 8:13102 (R:US)
Population Density
Distribution and abundance patterns of rocky intertidal fishes in central California, 8:13077 (J:NL)
FISSION
Nuclear Deformation
Nuclear-deformation energies according to a liquid-drop model with a sharp surface, 8:13335 (R:US)
FISSION FOIL DETECTORS
Calibration
Calibration of neutron dosimetry techniques for use in reactor buildings, 8:12991 (RA:US)
FISSION FRAGMENTS
Angular Distribution
Fission-fragment angular distributions and total kinetic energies for $^{238}U(n,f)$ from .18 to 8.83 MeV, 8:13348 (R:US)
Kinetic Energy
Average values and dispersions of fission fragment kinetic energies in terms of "touching fragments" model, 8:13350 (RA:SU:In Russian)

Fission-fragment angular distributions and total kinetic energies for $^{235}U(n,f)$ from .18 to 8.83 MeV, 8:13348 (R:US)

FISSION PRODUCT RELEASE
Coordinate with descriptors for the area of release such as BIOSPHERE or COOLANTS, and for the specific fission products, if known.
Meteorology
Investigation of the influence of modified parameters in the atmospheric dispersion model on the results of the German Risk Study (DRS), 8:13040 (R:DE:In German)

FISSION PRODUCTS
Nuclear Data Collections
ENDF/B fission-product data, 8:13321 (R:US)

FISSIONABLE MATERIALS MANAGEMENT
See NUCLEAR MATERIALS MANAGEMENT

FISSURED FORMATIONS
See FRACTURED RESERVOIRS

FIXATION (CARBON DIOXIDE)
See CARBON DIOXIDE FIXATION

FIXED MIRROR COLLECTORS
Technology Assessment
Survey of manufacturers of solar-thermal-energy systems, 8:12179 (R:US)

FLAME PROPAGATION
Velocity
Toward a comprehensive chemical kinetic mechanism for the oxidation of acetylene: comparison of model predictions with results from flame and shock tube experiments, 8:11965 (RA:US)

FLAMES
Chemical Composition
Toward a comprehensive chemical kinetic mechanism for the oxidation of acetylene: comparison of model predictions with results from flame and shock tube experiments, 8:11965 (RA:US)
Diagnostic Techniques
Particulate processes in pulverized-coal flames. Quarterly technical progress report, April-June, 8:11766 (R:US)
Holography
Particulate processes in pulverized-coal flames. Quarterly technical progress report, April-June, 8:11766 (R:US)
Turbulence
Mass fluxes anti rho' anti u' and anti rho' anti nu' measured in a turbulent nonpremixed flame, 8:12833 (RA:US)

FLAT PLATE COLLECTORS
Inclination
Optimum exposure of solar collectors with respect to atmospheric transmission of solar radiation, 8:12006 (RA:CH)
Insolation
Optimum exposure of solar collectors with respect to atmospheric transmission of solar radiation, 8:12006 (RA:CH)

FLAVOPROTEIN ENZYMES
See DIAPHORASE

FLAWS
See DEFECTS

FLOATING NUCLEAR POWER PLANTS
See OFFSHORE NUCLEAR POWER PLANTS

FLORIDA
Birds
Florida atlas of breeding sites for herons and their allies: 1976-1978, 8:13055 (R:US)
Coal Deposits
Florida peat resource assessment project, 8:11704 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Florida peat resource assessment project, 8:11704 (RA:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)

FLOW CYTOMETERS
See CELL FLOW SYSTEMS

FLOWMETERS
Calibration
Calibration of sonic flowmeters for Ocean Thermal Energy Conversion (OTEC), 8:12131 (R:US)
Nuclear Magnetic Resonance
Investigation of the effect of the uranyl ion on proton-spin-relaxation times in aqueous solutions, 8:13007 (R:US)

FLUE GAS
Desulfurization
Benefits of coal preparation, 8:11742 (RA:US)
Chemical and physical characterization of western low-rank-coal waste materials. Part 3. Sludges from wet scrubbers using fly ash as a scrubbing reagent. Final report, 8:11683 (R:US)
Coyote FGC system: a status report on a spray dryer/baghouse combination, 8:11686 (RA:US)
Dry-limestone injection test at a low-rank coal-fired power plant. Final report, 8:12282 (R:US)
Economics of coal preparation, 8:11743 (RA:US)
Unique features and operating experiences of the 1500-MW Laramie River Station utilizing Powder River Basin subbituminous coal, 8:12274 (RA:US)

FLUID INJECTION
See also MISCIBLE-PHASE DISPLACEMENT
STEAM INJECTION
WATERFLOODING
Regulations
Pending changes in the regulation of solid waste disposal and underground injection: impact of state programs in lieu of federal programs, 8:12221 (RA:US)
Reinjection
Pending changes in the regulation of solid waste disposal and underground injection: impact of state programs in lieu of federal programs, 8:12221 (RA:US)

FLUIDIZED BED
Radiant Heat Transfer
Development of an indirectly heated pyrolysis reactor, 8:11964 (RA:US)

FLUIDIZED BED REACTORS
Design
Single-stage fluidized-bed gasification, 8:11604 (RA:US)
Modifications
Single-stage fluidized-bed gasification, 8:11604 (RA:US)
Performance
Oxygen-blown entrained-flow gasification of wood, 8:11966 (RA:US)
Pressurized oxygen blown fluidized bed gasification of wood, 8:11967 (RA:US)

FLUIDIZED-BED COMBUSTION
Demonstration Plants
Tennessee Valley Authority's atmospheric fluidized bed combustion program, 8:11759 (RA:US)
Economic Analysis
Tennessee Valley Authority's atmospheric fluidized bed combustion program, 8:11759 (RA:US)
Efficiency
Fluidized-bed combustion studies of Texas lignite, 8:11769 (RA:US)
Technical and economic aspects of a lignite-fired AFBC boiler, 8:11768 (RA:US)
Pilot Plants
Tennessee Valley Authority's atmospheric fluidized bed combustion program, 8:11759 (RA:US)
Research Programs
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals (India), 8:11725 (RA:US)
Test Facilities
Fluidized-bed combustion studies of Texas lignite, 8:11769 (RA:US)
Technical and economic aspects of a lignite-fired AFBC boiler, 8:11768 (RA:US)

FLUIDIZED-BED COMBUSTORS
Bench-Scale Experiments
Carbon attrition during the fluidized combustion and gasification of coal. Quarterly technical progress report, 1 June 1982-31 August 1982, 8:11767 (R:US)

Commercialization
Development and commercialization of circulating fluidized bed combustion systems (Contains list of customers and uses), 8:11765 (RA:US)
Comparative Evaluations
Technical and economic aspects of a lignite-fired AFBC boiler, 8:11768 (RA:US)
Demonstration Plants
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Design
Development and commercialization of circulating fluidized bed combustion systems (Contains list of customers and uses), 8:11765 (RA:US)
Technical and economic aspects of a lignite-fired AFBC boiler, 8:11768 (RA:US)
Tennessee Valley Authority's atmospheric fluidized bed combustion program, 8:11759 (RA:US)
Economic Analysis
Technical and economic aspects of a lignite-fired AFBC boiler, 8:11768 (RA:US)
Materials Testing
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Systems Analysis
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)

FLUIDS
Not for BODY FLUIDS.
See also DRILLING FLUIDS
GASES
GEOTHERMAL FLUIDS
WORKING FLUIDS
Thermodynamic Properties
Thermodynamic properties of strongly nonideal fluid mixtures from an extended quasi-chemical theory, 8:12792 (R:US)

FLUID-STRUCTURE INTERACTIONS
Simulation
Fluid-structure coupling in Lagrange-Lagrange and Euler-Lagrange descriptions, 8:12392 (R:XE)

FLUORANTHENE
See CONDENSED AROMATICS

FLUORESCENT LAMPS
Ballasts
Integrated-circuit control for two-lamp electronic ballast. Final report, 8:12561 (R:US)
Design
Energy-efficient compact screw-in fluorescent lamp. Final report, 8:12562 (R:US)
Performance
Energy-efficient compact screw-in fluorescent lamp. Final report, 8:12562 (R:US)

FLUORINE
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

FLUORINE 18
Radiopharmaceuticals
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)
Tissue Distribution
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)
New method using anhydrous [^{18}F]fluoride to radiolabel 2-[^{18}F]fluoro-2-deoxy-D-glucose, 8:12826 (J:US)

FLUORINE FLUORIDES
See FLUORINE

FLUOROD
See RPL DOSEMETERS

FLY ASH
Activation Analysis
Procedures for multielement analysis using high-flux fast-neutron activation, 8:12767 (J:CH)
Chemical Analysis
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Chemical Composition
Geochemistry of leachates from selected coal mining and combustion wastes. Project completion report, July 1977-September 1979, 8:11692 (R:US)
Recycling
Technical and economic aspects of a lignite-fired AFBC boiler, 8:11768 (RA:US)
Waste Management
Impact of RCRA (PL 94-580) on the use or disposal of solid wastes from Texas lignite-fired utility boilers: a literature survey. Final report, 8:11687 (R:US)
Waste Product Utilization
Suction trenching, and the use of fly ash for backfilling, 8:11822 (TJ:GB)
Tennessee Valley Authority's atmospheric fluidized bed combustion program, 8:11759 (RA:US)

FLYWHEEL-POWERED VEHICLES
Performance
Analysis and comparison of automotive-propulsion systems, 8:12643 (R:US)

FMIT FACILITY
See FMIT LINAC

FMIT LINAC
Linear Accelerator at the Hanford Fusion Materials Irradiation Test Facility.
Remote Handling
Remote handling features of the fusion materials irradiation test (FMIT) facility, 8:13532 (J:US)
Remote Handling Equipment
Remote-handling demonstration tests for the Fusion Materials Irradiation Test (FMIT) Facility, 8:13482 (R:US)

FOAMS
See also PLASTIC FOAMS
Chemical Analysis
Applications of ion chromatography, 8:12747 (R:US)
Production
Determination of miscibility pressure by direct-observation method. Quarterly report, July 1-September 30, 1982, 8:11797 (R:US)

FOG (SPRAYS)
See SPRAYS

FOLIAGE
See LEAVES

FOOD
Global Aspects
Biomass: its utilization as food and/or fuel, 8:12027 (RA:BR)

FOOD CHAINS
Radionuclide Migration
Texas Panhandle soil-crop-beef food chain for uranium: a dynamic model validated by experimental data, 8:13065 (R:US)

FOODSTUFFS
See FOOD

FORESTS
Computerized Simulation
A computer model of succession and fire response of the high-altitude Eucalyptus forest of the Brindabella Range, Australian Capital Territory, 8:13057 (J:GB)

FORMATES
Ion Exchange Chromatography
Applications of ion chromatography, 8:12747 (R:US)

FORMING (MATERIALS)
See MATERIALS WORKING

FORMOSA
See TAIWAN

FOSSIL FUEL RESERVES
See FOSSIL FUELS

FOSSIL FUELS
See also COAL
NATURAL GAS
OIL SHALES
PEAT
PETROLEUM
SHALE OIL
Lectures
New technologies in fossil-fuel utilization, 8:12491 (R:US)

Research Programs
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
Technology Assessment
New technologies in fossil-fuel utilization, 8:12491 (R:US)
FOSSIL-FUEL POWER PLANTS
Air Pollution Abatement
Dry-limestone injection test at a low-rank coal-fired power plant. Final report, 8:12282 (R:US)
Air Pollution Control
Baghouse performance and ash characterization at the Arapahoe Power Station, 8:12281 (R:US)
Design for lignite firing at the San Miguel Power Plant, 8:12272 (RA:US)
Ashes
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Baghouses
Baghouse performance and ash characterization at the Arapahoe Power Station, 8:12281 (R:US)
Boiler Fuels
Design for lignite firing at the San Miguel Power Plant, 8:12272 (RA:US)
Boilers
Operating experience in burning lignite at Coal Creek Station, 8:11756 (RA:US)
Cogeneration
Turn in the road: Eastman chemicals from coal, 8:11596 (RA:US)
Combined-Cycle Power Plants
Coal-fired combined-cycle power generating plants of the future, 8:12280 (BA:US)
Comparative Evaluations
Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report, 8:11662 (R:US)
Technical and economic aspects of a lignite-fired AFBC boiler, 8:11768 (RA:US)
Constraints
Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report, 8:11662 (R:US)
Design
Unique features and operating experiences of the 1500-MW Laramie River Station utilizing Powder River Basin subbituminous coal, 8:12274 (RA:US)
Electrostatic Precipitators
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)
Energy Conservation
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)
Environmental Impacts
Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report, 8:11662 (R:US)
Fluidized-Bed Combustion
Computer simulation of the dynamic behaviour of a coal-fired power plant with pressurized fluidized bed, 8:12267 (R:DE:In German)
Fly Ash
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Suction trenching, and the use of fly ash for backfilling, 8:11822 (TJ:GB)
Fuel Consumption
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)
Fuel Substitution
Electric utility criteria and decisions: coal-oil mixtures, coal-oil-water mixtures and selected advanced coal systems, 8:11758 (RA:US)
Engineering analysis for Albany Power Plant. Final report, 8:12271 (R:US)
Final Northeast Regional Environmental Impact Statement: potential conversion of forty-two powerplants from oil to coal or alternate fuels (42 + 47 power plants; identification and location), 8:12270 (R:US)
Makret place economics and coal conversions, 8:12268 (RA:US)
Studies concerning the application of coal-water fuels to boilers designed for oil, 8:11762 (RA:US)
Fuel Supplies
Coal supply factor is it largely romance or a solid plus, 8:11773 (RA:US)
Regulations
Environmental/regulatory analysis of medium-Btu lignite gasification for industrial use. Final report, 8:11662 (R:US)
Retrofitting
Engineering analysis for Albany Power Plant. Final report, 8:12271 (R:US)
Scrubbers
Operating experience in burning lignite at Coal Creek Station, 8:11756 (RA:US)
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)
Site Selection
Coal supply factor is it largely romance or a solid plus, 8:11773 (RA:US)
Solar Repowering
Field optimization for the solar repowering of an electric utility near Abilene, Texas. Final report, 8:12124 (R:US)
Waste Management
Impact of RCRA (PL 94-580) on the use or disposal of solid wastes from Texas lignite-fired utility boilers: a literature survey. Final report, 8:11687 (R:US)
Water Requirements
Assessment of groundwater usage at Chalk Point power plant. Final report, 8:12278 (R:US)
Water Supply
Unique features and operating experiences of the 1500-MW Laramie River Station utilizing Powder River Basin subbituminous coal, 8:12274 (RA:US)
FOUR-PI COUNTING
Four-Pi Counting
Activity determination by a 4π-γ well-type ionization chamber, 8:12967 (R:BR)
Ionization Chambers
Activity determination by a 4π-γ well-type ionization chamber, 8:12967 (R:BR)
FRACTURED FORMATIONS
See FRACTURED RESERVOIRS
FRACTURED RESERVOIRS
Mathematical Models
Flow-test evaluation of fractured reservoirs, 8:13204 (J:US)
Permeability
Assessing the permeability characteristics of fractured rock, 8:13203 (J:US)
FRAGMENTS (FALLOUT)
See FALLOUT
FRAGMENTS (FISSION)
See FISSION FRAGMENTS
FRANCIUM 212
Alpha Decay
Simplified and semisimplified α-decay of N=125 nuclei and effective nucleon-nucleon interaction, 8:13345 (RA:SU:In Russian)
FREDHOLM EQUATION
Analytical Solution
UFO (UnFold Operator) computer program abstract, 8:13562 (R:US)
FREE ELECTRON LASERS
Electric Fields
High energy e^+-e^- collider using an inverse free electron laser accelerator, 8:12894 (R:US)
Linear Accelerators
Linac technology for free-electron lasers, 8:12865 (R:US)
Simulation
One-dimensional numerical simulation of a free-electron laser - storage-ring system, 8:12864 (R:US)
Standing Waves
High energy e^+-e^- collider using an inverse free electron laser accelerator, 8:12894 (R:US)
Wiggler Magnets
Brookhaven free-electron laser experiment, 8:12937 (R:US)

FREE RADICALS
See RADICALS
FREIGHT
See CARGO
FREIGHT PIPELINES
See also SLURRY PIPELINES
Energy Consumption
Prospects for energy conservation in the pipeline industry, 8:12589 (RA:US)
FRENCH ORGANIZATIONS
Research Programs
Report of activity, 8:12471 (R:FR:FR)
FRESH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS
FRICKE DOSEMETERS
See CHEMICAL DOSEMETERS
FRICTIONLESS FLOW
See IDEAL FLOW
FRUCTOSE
Fermentation
Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms, 8:13135 (BA:US)
FTR REACTOR (RICHLAND)
See FFTF REACTOR
FUEL ADDITIVES
Comparative Evaluations
Recent research on ash fouling in combustion of low-rank coals, 8:12275 (RA:US)
Performance Testing
Application of dry additives on reducing SO_2 emission for brown coal-fired boilers, 8:12283 (RA:US)
FUEL ASSEMBLIES
See also FUEL ELEMENT CLUSTERS
Burnup
Evaluation and demonstration of methods for improved nuclear fuel utilization. Fourth semiannual progress report, July 1 to December 31, 1981 (PWR), 8:12334 (R:US)
Fuel Management
Evaluation and demonstration of methods for improved nuclear fuel utilization. Fourth semiannual progress report, July 1 to December 31, 1981 (PWR), 8:12334 (R:US)
Heat Transfer
User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis (LMFBR), 8:12314 (R:US)
User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis (LMFBR), 8:12315 (R:US)
Hydraulics
User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis (LMFBR), 8:12314 (R:US)
User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis (LMFBR), 8:12315 (R:US)
Performance Testing
Evaluation and demonstration of methods for improved nuclear fuel utilization. Fourth semiannual progress report, July 1 to December 31, 1981 (PWR), 8:12334 (R:US)
FUEL BUNDLES
See FUEL ELEMENT CLUSTERS
FUEL CANS
Sample Preparation
SEM-TEM Sampling technique for use with fuel LWR cladding, 8:12432 (J:US)
FUEL CELL POWER PLANTS
For commercial, residential, or electric utility use.
Fuel cells for electric utility applications, 8:12539 (BA:US)
Coal Gasification
Carbonate fuel cell power plant systems, 8:12544 (BA:US)
Electricity generation from coal using fuel cells: preliminary systems analysis, 8:12537 (BA:US)
Combined-Cycle Power Plants
Carbonate fuel cell power plant systems, 8:12544 (BA:US)
Demonstration Plants
4.8 MW fuel cell demonstratrator: a step toward commercialization, 8:12540 (BA:US)
Feasibility Studies
Fuel-cell power-system configurations utilizing waste-derived fuels. Summary of final technical report for the period September 1977-August 1978, 8:12525 (R:US)
Fuels
Fuel-cell power-system configurations utilizing waste-derived fuels. Summary of final technical report for the period September 1977-August 1978, 8:12525 (R:US)
Systems Analysis
Electricity generation from coal using fuel cells: preliminary systems analysis, 8:12537 (BA:US)
Technology Assessment
On-site fuel cell power plant technology development program. Annual report Jan 81-Dec 81, 8:12523 (R:US)
FUEL CELLS
See also ACID ELECTROLYTE FUEL CELLS
HIGH-TEMPERATURE FUEL CELLS
HYDROCARBON FUEL CELLS
Seven technologies for the eighties, 8:12470 (R:US)
Cogeneration
Role of fuel cells in industrial cogeneration, 8:12542 (BA:US)
Design
Fuel cell systems and potential applications, 8:12533 (BA:US)
Economics
Carbonate fuel cell system development for industrial cogeneration. Final report Mar 80-Aug 81, 8:12524 (R:US)
Electrocatalysts
Advanced chemistry and materials for fuel cells, 8:12520 (R:US)
Feasibility Studies
Carbonate fuel cell system development for industrial cogeneration. Final report Mar 80-Aug 81, 8:12524 (R:US)
Fuel Supplies
Outlook for fuel supplies for fuel cells, 8:12536 (BA:US)
Fuel Systems
Processing of liquid hydrocarbons for fuel cell applications, 8:12538 (BA:US)
Marketing Research
Fuel-cell technology assessment. Volume I. The potential value of US fuel-cell technology in foreign countries, 8:12526 (R:US)
Fuel-cell technology assessment. Volume II. Evaluation of Japan, 8:12527 (R:US)
Fuel-cell technology assessment. Volume III. Evaluation of Tunisia, 8:12528 (R:US)
Fuel-cell technology assessment. Volume V. Evaluation of South Korea, 8:12530 (R:US)
Fuel-cell technology assessment. Volume IV. Evaluation of Taiwan, 8:12529 (R:US)
Meetings
Fuel cells: technology status and applications. Symposium proceedings, 8:12531 (B:US)
Operation
Fuel cells: fundamentals and types - unique features, 8:12532 (BA:US)
Performance
Analysis and comparison of automotive-propulsion systems, 8:12643 (R:US)
On-site fuel cell power plant technology development program. Annual report Jan 81-Dec 81, 8:12523 (R:US)
Technology Assessment
Carbonate fuel cell system development for industrial cogeneration. Final report Mar 80-Aug 81, 8:12524 (R:US)
Fuel-cell technology assessment. Volume I. The potential value of US fuel-cell technology in foreign countries, 8:12526 (R:US)
Thermodynamics
Fuel cells: fundamentals and types - unique features, 8:12532 (BA:US)
Uses
Defense applications of fuel cells, 8:12535 (BA:US)
Engelhard fuel cell programs, 8:12545 (BA:US)
Fuel cell systems and potential applications, 8:12533 (BA:US)

FUEL CONSUMPTION
Forecasting
Methodology and results of the impacts of modeling electric utilities: a comparative evaluation of MEMM and REM, 8:12507 (R:US)
FUEL COOLING INSTALLATIONS
See SPENT FUEL STORAGE
FUEL CYCLE
See also PLUTONIUM RECYCLE
Cost
Nuclear-fuel-cycle costs. Consolidated Fuel-Reprocessing Program, 8:11847 (R:US)
Health Hazards
Occupational risk from nuclear power, 8:11931 (J:US)
Mathematical Models
Enrichment, demand, planning, facility deployment, and pricing, 8:11932 (R:US)
Optimal Control
Iterative solution to the optimal control of depletion problem in pressurized water reactors, 8:12310 (D:US)
Optimization
Extended burnup fuel cycle optimization for pressurized water reactors (PUFLAC;DSPWR), 8:12311 (D:US)
FUEL ECONOMY
Forecasting
Maintaining automotive mobility: using fuel economy and synthetic fuels to compete with OPEC oil. Final report, 8:12612 (R:US)
Standards
Nature and characteristics of federal fuel economy standards, 8:12594 (RA:US)
FUEL ELEMENT CLUSTERS
Evaluation
Gamma emmission tomography of irradiated fuel bundles, 8:12360 (J:US)
Flow Models
Semi-empirical model for the calculation of flow friction factors in wire-wrapped rod bundles, 8:12317 (R:BR:In Portuguese)
Fluid Flow
Experimental investigations on the fluid flow through an asymmetric rod bundle (W/D = 1.118), 8:12869 (R:DE:In German)
Gamma Fuel Scanning
Gamma emmission tomography of irradiated fuel bundles, 8:12360 (J:US)
Pressure Drop
Measurements of peripherical static pressure and pressure drop in a rod bundle with helical wire wrap spacers, 8:12316 (R:BR:In Portuguese)
Pressure Measurement
Measurements of peripherical static pressure and pressure drop in a rod bundle with helical wire wrap spacers, 8:12316 (R:BR:In Portuguese)
Spacers
Semi-empirical model for the calculation of flow friction factors in wire-wrapped rod bundles, 8:12317 (R:BR:In Portuguese)
FUEL ELEMENTS
See also FUEL PINS
FUEL RODS
SPENT FUEL ELEMENTS
Burnup
Comparative performance of a 10-MW generic reactor with HEU and LEU fuels, 8:12373 (J:US)
Design
State of art of the methods for thermohydraulics design of LMFBR fuel elements, 8:12318 (R:BR:In Portuguese)
Reactor Fueling
Reduced-enrichment fuel element loading calculations for the Ford Nuclear Reactor, 8:12380 (J:US)
FUEL FABRICATION PLANTS
See also MIXED OXIDE FUEL FABRICATION PLANTS
Radioactive Waste Management
Plutonium fuel fabrication residues and wastes, 8:11865 (R:FR)
FUEL FEEDING SYSTEMS
Technology Assessment
Feeding coal and biomass into high pressure reactors, 8:12090 (RA:US)
Test Facilities
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals, 8:11725 (RA:US)
FUEL GAS
See also HIGH BTU GAS
NATURAL GAS
Calorific Value
KBW: improvements on a well-known process, 8:11586 (RA:US)
Large-block experiments in underground coal gasification, 8:11664 (RA:US)
Chemical Composition
British Gas slagging gasifier - a springboard into synfuels, 8:11587 (RA:US)
KBW: improvements on a well-known process, 8:11586 (RA:US)
Large-block experiments in underground coal gasification, 8:11664 (RA:US)
Recent developments in high pressure, entrained flow, slagging gasification of coal update of Bi-Gas Pilot Plant Operations, 8:11589 (RA:US)
Comparative Evaluations
Fuel oil substitution by enriched medium Btu gas produced from coal in Winkler fluidized gasifiers (Including partially methanated synthesis gas), 8:11590 (RA:US)
Cost
British Gas slagging gasifier - a springboard into synfuels, 8:11587 (RA:US)
Feasibility study of a Texas lignite-gasification facility to fuel: a small industrial plant. Final report, 8:11785 (R:US)
Desulfurization
Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)
Studies on the regeneration of sulfided iron oxide sorbent with steam-air mixtures. Final technical report, 8:11626 (R:US)
Systems model of the iron oxide hot gas clean-up process. Volume II. Hotgas user's manual. Final report, September 1979-December 1980, 8:11661 (R:US)
Hot Gas Cleanup
Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)
Studies on the regeneration of sulfided iron oxide sorbent with steam-air mixtures. Final technical report, 8:11626 (R:US)
Systems model of the iron oxide hot gas clean-up process. Volume II. Hotgas user's manual. Final report, September 1979-December 1980, 8:11661 (R:US)
Impurities
Gas characterization from fluidized-bed coal gasification. Fourth quarterly report, June 1-August 31, 1982, 8:11627 (R:US)
Methanation
Fuel oil substitution by enriched medium Btu gas produced from coal in Winkler fluidized gasifiers (Including partially methanated synthesis gas), 8:11590 (RA:US)
Purification
British Gas slagging gasifier - a springboard into synfuels, 8:11587 (RA:US)
Shell coal gasification process, 8:11585 (RA:US)
Scrubbing
IGT U-GAS pilot plant scrubber effluent analysis, 8:11682 (R:US)
FUEL MANAGEMENT
Evaluation and demonstration of methods for improved nuclear fuel utilization. Fourth semiannual progress report, July 1 to December 31, 1981 (PWR), 8:12334 (R:US)
FUEL OILS
See also HEATING OILS
RESIDUAL FUELS
Cost
Commercial energy costs for SOLCOST Data Bank cities, winter 1981-1982, 8:12014 (R:US)

FUEL PELLETS
Cracks
Survey on fuel pellet cracking and healing phenomena in reactor operation, 8:12357 (R:BR)
Inspection
High-burnup PWR ramp test program. Background topical report, Petten ramp test results, 8:12303 (R:US)
Performance
Introduction to current modeling techniques in nuclear fuel performance analysis, 8:12356 (R:BR)
Survey on fuel pellet cracking and healing phenomena in reactor operation, 8:12357 (R:BR)
Performance Testing
High-burnup PWR ramp test program. Background topical report, Petten ramp test results, 8:12303 (R:US)
FUEL PENCILS
See FUEL PINS
FUEL PINS
Creep
Enhanced irradiation creep deformation due to gradual temperature reductions, 8:12359 (J:NL)
Physical Radiation Effects
Enhanced irradiation creep deformation due to gradual temperature reductions, 8:12359 (J:NL)
Swelling
Enhanced irradiation creep deformation due to gradual temperature reductions, 8:12359 (J:NL)
FUEL REPROCESSING PLANTS
Safeguards
Demonstration of microscopic process monitoring for reprocessing plant safeguards, 8:11943 (J:US)
Results of research and development work 1981 of the Development Department for Nuclear Materials Safeguards, 8:11938 (R:DE:In German)
FUEL RODS
Mechanical Vibrations
Fuel-rod vibration with reduced spacer spring preload, 8:12293 (R:US)
Fuel-rod vibration in two-phase flow (BWR), 8:12291 (R:US)
Post-Irradiation Examination
Evaluation of fuel rods behavior - under irradiation test, 8:12358 (R:BR:In Portuguese)
Test Facilities
Fuel-rod vibration in two-phase flow (BWR), 8:12291 (R:US)
Testing
Evaluation of fuel rods behavior - under irradiation test, 8:12358 (R:BR:In Portuguese)
FUEL SHEATHS
See FUEL CANS
FUEL SLUGS
See FUEL RODS
FUEL SLURRIES
Industrial coal utilization: fourth annual symposium, 8:11780 (R:US)
Atomization
Investigation of vaporization and devolatilization of coal/water mixtures. Second quarterly report, July 20, 1982-October 19, 1982, 8:11642 (R:US)
Availability
Commercial availability of coal-oil and coal-water fuels (Contains list of 6 companies offering COM and brief description of preparatory method), 8:11760 (RA:US)
Combustion
Investigation of vaporization and devolatilization of coal/water mixtures. Second quarterly report, July 20, 1982-October 19, 1982, 8:11642 (R:US)
Combustion Properties
Industrial potentials of coal-alcohol slurry fuels (Methacoal (patented)), 8:11763 (RA:US)
Studies concerning the application of coal-water fuels to boilers designed for oil, 8:11762 (RA:US)
Commercialization
Commercial availability of coal-oil and coal-water fuels (Contains list of 6 companies offering COM and brief description of preparatory method), 8:11760 (RA:US)
Studies concerning the application of coal-water fuels to boilers designed for oil, 8:11762 (RA:US)
Economics
Commercial availability of coal-oil and coal-water fuels (Contains list of 6 companies offering COM and brief description of preparatory method), 8:11760 (RA:US)
Industrial potentials of coal-alcohol slurry fuels (Methacoal (patented)), 8:11763 (RA:US)
Fuel Substitution
Electric utility criteria and decisions: coal-oil mixtures, coal-oil-water mixtures and selected advanced coal systems, 8:11758 (RA:US)
Hydraulic Transport
Industrial potentials of coal-alcohol slurry fuels (Methacoal (patented)), 8:11763 (RA:US)
Multiphase Flow
Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982, 8:11638 (R:US)
Pressure Drop
Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982, 8:11638 (R:US)
Rheology
9.6 appendix F: analysis of rheological data for SRC solvent coal slurries: Ft. Lewis and Wilsonville solvents, 8:11656 (RA:US)
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Thermal Conductivity
Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982, 8:11638 (R:US)
Viscosity
9.6 appendix F: analysis of rheological data for SRC solvent coal slurries: Ft. Lewis and Wilsonville solvents, 8:11656 (RA:US)
Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982, 8:11638 (R:US)
FUEL SUBSTITUTION
Economics
Conversion of an industrial boiler to Coal-Oil Mixture, 8:11761 (RA:US)
Environmental Impact Statements
Final Northeast Regional Environmental Impact Statement: potential conversion of forty-two powerplants from oil to coal or alternate fuels (42 + 47 power plants; identification and location), 8:12270 (R:US)
Feasibility Studies
Conversion of an industrial boiler to Coal-Oil Mixture, 8:11761 (RA:US)
Legal Aspects
Electric utilities and natural gas use, 8:12484 (R:US)
FUEL SUPPLIES
Antitrust Laws
Selected antitrust issues in utility fuels and equipment purchases, 8:12499 (R:US)
Availability
Electric utilities and natural gas use, 8:12484 (R:US)
Competition
Selected antitrust issues in utility fuels and equipment purchases, 8:12499 (R:US)
Forecasting
Outlook for fuel supplies for fuel cells, 8:12536 (BA:US)
Legal Aspects
Selected antitrust issues in utility fuels and equipment purchases, 8:12499 (R:US)
Prices
Electric utilities and natural gas use, 8:12484 (R:US)
FUEL SUSPENSIONS
See FUEL SLURRIES
FUEL-AIR RATIO
Control Systems
Development of new combustion control equipment. Application to a modern range of gas burners and the resulting savings. The move towards permanent closed loop combustion control, 8:12893 (TG:GB)

FUELS (NUCLEAR)
See NUCLEAR FUELS
FUELWOOD
See WOOD FUELS
FULVIC ACIDS
Flocculation
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
FUMES
See AEROSOLS
FUNCTIONS
See also GREEN FUNCTION
LAGRANGIAN FUNCTION
Mathematical Logic
Monotone Boolean approximation, 8:13563 (R:US)
FUNGI
Cellulolytic Activity
Regulatory mechanisms in Thielavia terrestris. Final report, 8:13134 (R:US)
2-FURALALDEHYDE
See FURFURAL
FURFURAL
Electrolysis
Design, evaluation, and application of continuous-flow cells for organic electrochemical synthesis. Final report, 8:12814 (R:US)
FURNACE OIL
See HEATING OILS
FUSION FUELS
See THERMONUCLEAR FUELS
FUSION REACTORS
See THERMONUCLEAR REACTORS
FUSION (WELDING)
See WELDING

G

GADOLINIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
GADOLINIUM COMPOUNDS
Phase Transformations
Moessbauer studies of orientational transitions in substituted ferrite garnets, 8:12782 (RA:SU:In Russian)
GALACTOSE
Fermentation
Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms, 8:13135 (BA:US)
GALLIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
GALLIUM 67
Excretion
Enhancement of radiopharmaceutical excretion by chemical interventions, 8:13176 (R:US)
GALLIUM ALLOYS
Chemical Preparation
Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga), 8:12697 (J:US)
Hydridation
Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga), 8:12697 (J:US)
GALLIUM ARSENIDES
Doping and transport studies in In/sub x/Ga/sub 1-x/As/GaAs strained-layer superlattices, 8:12741 (R:US)
Electrical Properties
Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R:US)
Heterojunctions
Ga(As,P) strained-layer superlattices: a ternary semiconductor with independently adjustable band gap and lattice constant, 8:12886 (R:US)
Interfaces
Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R:US)
Optical Properties
Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R:US)
Superlattices
Ga(As,P) strained-layer superlattices: a ternary semiconductor with independently adjustable band gap and lattice constant, 8:12886 (R:US)
Vapor Phase Epitaxy
Investigation of the electrical and optical properties of organometallic vapor-phase epitaxial Al/sub x/Ga/sub 1-x/As and Al/sub x/Ga/sub 1-x/As/GaAs interfaces in solar cells. Progress report, 16 December 1981-1 December 1982, 8:12043 (R:US)
GALLIUM PHOSPHIDES
Heterojunctions
Ga(As,P) strained-layer superlattices: a ternary semiconductor with independently adjustable band gap and lattice constant, 8:12886 (R:US)
Superlattices
Ga(As,P) strained-layer superlattices: a ternary semiconductor with independently adjustable band gap and lattice constant, 8:12886 (R:US)
GAMMA DETECTION
Cherenkov Counters
Lead-glass gamma-ray detector for relativistic heavy-ion collisions, 8:12995 (J:NL)
Ge Semiconductor Detectors
Efficiency calibration of a Ge detector for 30-2800 keV γ rays, 8:12996 (J:NL)
Plastic Scintillation Detectors
Lead-glass gamma-ray detector for relativistic heavy-ion collisions, 8:12995 (J:NL)
Semiconductor Detectors
Bismuth germanate as a high-energy gamma-ray detector, 8:12971 (R:US)
Shower Counters
Lead-glass gamma-ray detector for relativistic heavy-ion collisions, 8:12995 (J:NL)
GAMMA DOSIMETRY
Measurements and modeling of gamma absorbed doses due to releases from a linear proton accelerator: experimental design and preliminary results, 8:13043 (R:US)
GAMMA FUEL SCANNING
Emission Computed Tomography
Gamma emmission tomography of irradiated fuel bundles, 8:12360 (J:US)
GAMMA RADIATION
Shielding
EBT-P gamma-ray shielding analysis, 8:13512 (J:US)
GAMMA SPECTRA
Experimental Data
Gamma rays from the interactions of reactor fast neutrons ordered by increasing gamma-ray energy, 8:13334 (R:US)

GAMMA SPECTROMETERS
Data Analysis
GAUSS VII: a computer program for the analysis of γ-ray spectra from Ge semiconductor spectrometers, 8:12948 (R:US)
HgI2 Semiconductor Detectors
Recent developments in thick mercuric iodide spectrometers, 8:12946 (R:US)
GAMMA TRANSPORT THEORY
Raffle V general purpose Monte Carlo code for neutron and gamma transport, 8:12339 (R:US)
Streaming of 14-MeV neutrons through an iron duct: comparison of measured neutron and gamma-ray energy spectra with results calculated using the Monte Carlo code MCNP, 8:13492 (R:US)
GARDENHOSE INSTABILITY
See HOSE INSTABILITY
GAS APPLIANCES
Performance Testing
Investigations and experiments by SNAM on the interchangeability of gases (From different sources and mixtures or additions of other listed gases; various indices compared), 8:11823 (TG:GB)
GAS BURNERS
Combustion Control
Development of new combustion control equipment. Application to a modern range of gas burners and the resulting savings. The move towards permanent closed loop combustion control, 8:12893 (TG:GB)
Energy Conservation
Energy efficient industrial technology in Europe: a compendium. Interim report May 79-Feb 82, 8:12625 (R:US)
Fuel-Air Ratio
Development of new combustion control equipment. Application to a modern range of gas burners and the resulting savings. The move towards permanent closed loop combustion control, 8:12893 (TG:GB)
GAS CENTRIFUGES
Gas Flow
Finite element method for the Onsager pancake equation, 8:11844 (J:NL)
GAS COMPRESSORS
Computerized Simulation
Study of hydraulic air compression for Ocean Thermal Energy Conversion open-cycle application, 8:12132 (R:US)
Hydraulics
Study of hydraulic air compression for Ocean Thermal Energy Conversion open-cycle application, 8:12132 (R:US)
Testing
Study of hydraulic air compression for Ocean Thermal Energy Conversion open-cycle application, 8:12132 (R:US)
GAS COOLANTS
See GASES
GAS COOLED FAST BREEDER REACTORS
See GCFR TYPE REACTORS
GAS ENGINES
See INTERNAL COMBUSTION ENGINES
GAS LASERS
Use of nitrogen laser for observation of space-charge effects in drift chambers, 8:12992 (R:US)
GAS SPILLS
Water Pollution Abatement
Flare system for safe disposal of LNG from a disabled tanker, 8:13080 (R:US)
GAS TUNGSTEN-ARC WELDING
Process Control
Ultrasonic detection of molten/solid interfaces of weld pools, 8:12670 (R:US)
GAS TURBINES
Design
Conceptual integrated gasifier combined-cycle power-plant design. Final report, 8:11621 (R:US)
Preliminary design of an alternate high-temperature turbine. A topical report for Phase II of the High-Temperature-Turbine Technology Program, 8:12276 (R:US)
Fuel Substitution
Development of wood as an alternative fuel for gas turbine systems, 8:12079 (RA:US)
Performance
Preliminary design of an alternate high-temperature turbine. A topical report for Phase II of the High-Temperature-Turbine Technology Program, 8:12276 (R:US)
Testing
Gas turbine demonstration of pyrolysis-derived fuels, 8:12080 (RA:US)
GAS UTILITIES
Horizontal Integration
Homeowners survey: gas utilities and the residential solar market, 8:12640 (R:US)
GAS WELLS
See NATURAL GAS WELLS
GASEOUS EFFLUENTS
See GASEOUS WASTES
GASEOUS WASTES
See also FLUE GAS
Carbon Monoxide
Boiler efficiency and emissions testing using refuse-derived fuel (RDF) and coal, Wright-Patterson Air Force Base, Ohio 45433. Final report 21-26 Feb 82, 8:12892 (R:US)
Nitrogen Oxides
Boiler efficiency and emissions testing using refuse-derived fuel (RDF) and coal, Wright-Patterson Air Force Base, Ohio 45433. Final report 21-26 Feb 82, 8:12892 (R:US)
Particulates
Boiler efficiency and emissions testing using refuse-derived fuel (RDF) and coal, Wright-Patterson Air Force Base, Ohio 45433. Final report 21-26 Feb 82, 8:12892 (R:US)
Sulfur Oxides
Boiler efficiency and emissions testing using refuse-derived fuel (RDF) and coal, Wright-Patterson Air Force Base, Ohio 45433. Final report 21-26 Feb 82, 8:12892 (R:US)
GASES
See also ELECTRON GAS and FERMI GAS.
See also AIR
COAL GAS
FUEL GAS
RARE GASES
SYNTHESIS GAS
VAPORS
Adsorption
Analysis of gas purification by heatless adsorption, 8:12748 (R:US)
Ionization
Configurational testing of electron-beam ionization for coal-fly-ash precipitators. Quarterly report No. 5, December 2, 1981-March 1, 1982, 8:11685 (R:US)
Purification
Analysis of gas purification by heatless adsorption, 8:12748 (R:US)
Separation Processes
Analysis of gas purification by heatless adsorption, 8:12748 (R:US)
GASIFICATION
Any technique for converting coal or other products into gaseous fuel.
See also COAL GASIFICATION
IN-SITU GASIFICATION
Catalysts
Investigation of gasification of biomass in the presence of catalysts, 8:12067 (R:US)
Chemical Reactors
Comparative analysis of peat gasification reactor configurations, 8:11606 (RA:US)
Thagard high-temperature fluid-wall reactor for syngas generation from biomass, 8:12091 (RA:US)
Economics
Comparison of coal and wood as feedstocks for methanol manufacture, 8:11658 (RA:US)
Feasibility Studies
Peat as a feedstock to the KBW gasification process, 8:11659 (RA:US)

GASOHOL
Previous to August, 1979 this concept was indexed as gasoline AND mixtures AND ethanol or methanol.
Market
Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 1. Appendices. Executive overview (Alabama), 8:11976 (R:US)
Production
Feasibility study for a 40-MGY/80-MGY fuel-alcohol production plant. Volume 1. Appendices. Executive overview (Alabama), 8:11976 (R:US)
GASOLINE
Allocations
Transportation contingency planning, 8:12609 (RA:US)
Production
Oil refining flexibility and alternative fuels (Brazil), 8:11807 (RA:BR)
GASOLINE ENGINES
See INTERNAL COMBUSTION ENGINES
GASTEROPODS
See MOLLUSCS
GAUGE INVARIANCE
Coupling Constants
Comments on gauge hierarchies, 8:13282 (R:BR)
GAUGE TRANSFORMATIONS
See GAUGE INVARIANCE
GCFR TYPE REACTORS
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R:US)
Thorium Cycle
Possible types of breeders with thorium cycle, 8:12312 (R:BR:In Portuguese)
GE SEMICONDUCTOR DETECTORS
See also HIGH-PURITY GE DETECTORS
Calibration
Efficiency calibration of a Ge detector for 30-2800 keV γ rays, 8:12996 (J:NL)
Data Analysis
GAUSS VII: a computer program for the analysis of γ-ray spectra from Ge semiconductor spectrometers, 8:12948 (R:US)
Efficiency
Efficiency calibration of a Ge detector for 30-2800 keV γ rays, 8:12996 (J:NL)
GEIGER-MUELLER COUNTERS
Neutron Detection
Measuring the neutron sensitivity of a Geiger-Mueller counter by time-of-flight spectroscopy, 8:12961 (RA:DE:In German)
GENE MUTATIONS
Structural Chemical Analysis
Ds controlling elements of maize at the shrunken locus are large and dissimilar insertions, 8:13124 (J:US)
GENE RECOMBINATION
Genetic Mapping
Ds controlling elements of maize at the shrunken locus are large and dissimilar insertions, 8:13124 (J:US)
GENERAL RELATIVITY THEORY
Instability
Another gravitational instability of flat space-time, 8:13410 (J:NL)
GENERATORS (ELECTRIC)
See ELECTRIC GENERATORS
GENERATORS (STEAM)
See STEAM GENERATORS
GEOCHRONOLOGY
See AGE ESTIMATION
GEOLOGIC DEPOSITS
See also COAL DEPOSITS
NATURAL GAS DEPOSITS
PETROLEUM DEPOSITS
SALT DEPOSITS
URANIUM DEPOSITS
Geology
Hydrogeology of radioactive waste isolation: the challenge of a rational assessment, 8:11918 (J:US)
Hydrology
Hydrogeology of radioactive waste isolation: the challenge of a rational assessment, 8:11918 (J:US)
Radionuclide Migration
Contaminant migration in saturated unconsolidated geologic deposits, 8:13200 (J:US)
GEOLOGICAL SURVEYS
Bibliographies
Bibliography and index of Wyoming uranium through 1973. Bulletin 61, 8:11826 (R:US)
GEOLOGY
Meetings
Recent trends in hydrogeology, 8:13198 (B:US)
GEOPHONES
See SEISMIC DETECTORS
GEOPRESSURED SYSTEMS
Evaluation
Screening of three proposed DOE geopressured-geothermal aquifer natural gas project areas for potential conflicting commercial production: Freshwater Bayou, Lake Theriot, and Kaplan, Louisiana, 8:12200 (R:US)
Geothermal Wells
Geopressured-geothermal well report. Volume I. Drilling and completion, 8:12197 (R:US)
Gladys McCall geopressured design well. Annual progress report, October 1, 1980-September 30, 1981. T-F and S/DOE Gladys McMcall No. 1 well, Cameron Parish, Louisiana, 8:12244 (R:US)
Land Leasing
Evaluation of land ownership, lease status, and surface features in five geopressured geothermal prospects, 8:12229 (R:US)
Ownership
Evaluation of land ownership, lease status, and surface features in five geopressured geothermal prospects, 8:12229 (R:US)
Well Logging
Analysis of three geopressured geothermal aquifer-natural gas fields; Duson Hollywood and Church Point, Louisiana, 8:12186 (R:US)
GEORGIA
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Peat resource estimation in Georgia, 8:11705 (RA:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
GEOTHERMAL DISTRICT HEATING
Financing
District heating: legal, institutional, and public relations aspects, 8:12224 (RA:US)
Legal Aspects
District heating: legal, institutional, and public relations aspects, 8:12224 (RA:US)
GEOTHERMAL ENERGY
Bibliographies
Geothermal Energy Technology: a current-awareness bulletin, 8:12182 (R:US)
Cost
SCE resources in the 1980's, 8:12239 (RA:US)
Demonstration Programs
Texas geothermal R D & D program planning support document. Final report, 8:12183 (R:US)
Energy Source Development
Streamlining internal administrative procedures for geothermal development at the US Geological Survey, US Bureau of Land Management and the US Forest Service, 8:12219 (RA:US)
Interagency Cooperation
Streamlining internal administrative procedures for geothermal development at the US Geological Survey, US Bureau of Land Management and the US Forest Service, 8:12219 (RA:US)
Legal Aspects
Federal legislation affecting geothermal development, 8:12222 (RA:US)
Geothermal energy: the institutional maze and its changing structure, 8:12217 (R:US)

Market
Geothermal development plan: Maricopa County, 8:12230 (R:US)
Geothermal development plan: Pima County, 8:12231 (R:US)
Geothermal development plan: northern Arizona counties, 8:12232 (R:US)
Geothermal development plan: Pinal County, 8:12233 (R:US)
Geothermal development plan: Cochise/Santa Cruz Counties, 8:12234 (R:US)
Geothermal development plan: Yuma County, 8:12235 (R:US)
Geothermal development plan: Graham/Greenlee Counties, 8:12236 (R:US)
Potential of utilization of geothermal energy in Arizona. Executive summary, 8:12185 (R:US)
Meetings
Geothermal energy: the institutional maze and its changing structure, 8:12217 (R:US)
Research Programs
Texas Energy Development Fund. Project status reports, 8:11998 (R:US)
Texas geothermal R D & D program planning support document. Final report, 8:12183 (R:US)

GEOTHERMAL FLUIDS
Reinjection
Prediction of chemical problems in the reinjection of geothermal brines, 8:12238 (J:US)
Scale Control
Treatment methods for geothermal brines, 8:12252 (J:US)

GEOTHERMAL INDUSTRY
Legal Aspects
PURPA benefits for geothermal power producers: assured markets and regulatory exemptions, 8:12223 (RA:US)

GEOTHERMAL POWER PLANTS
Binary-Fluid Systems
Condensation of Refrigerant-11 on the outside of horizontal and inclined enhanced tubes, 8:12241 (R:US)
Decisions and Orders
Implications of the California Public Utilities Commission's decision on the proposed Southern California Edison/Chevron Resources Power Plant at Heber, California, 8:12225 (RA:US)

GEOTHERMAL PROCESS HEAT
Economics
Heber Known Geothermal Resources Area ethanol-fuel facility. Final technical report, 8:12056 (R:US)

GEOTHERMAL RESOURCES
Air Pollution
Legal and institutional overview: by land and air - the struggle continues, 8:12220 (RA:US)
Government Policies
Legal and institutional overview: by land and air - the struggle continues, 8:12220 (RA:US)
Land Leasing
Legal and institutional overview: by land and air - the struggle continues, 8:12220 (RA:US)
Leasing
Attitudes of the Reagan Administration toward geothermal development, 8:12218 (RA:US)
Legal Aspects
Laws and regulations governing procurement, 8:12227 (RA:US)
Resource Development
Special requirements and procedures for geothermal development on Navy lands, 8:12226 (RA:US)
Resource Potential
Opportunities for industry in the development of geothermal energy at US military installations, 8:12184 (RA:US)

GEOTHERMAL SYSTEMS
See also HOT-DRY-ROCK SYSTEMS
MAGMA SYSTEMS
Geology
Recent trends in hydrogeology, 8:13198 (B:US)
Hydrology
Recent trends in hydrogeology, 8:13198 (B:US)
Meetings
Recent trends in hydrogeology, 8:13198 (B:US)
Two-Phase Flow
Physics of flow in geothermal systems, 8:12250 (J:US)

GEOTHERMAL WELLS
Acidization
Acidification of geothermal wells: Laboratory experiments. Geothermal Reservoir Well-Stimulation program, 8:12243 (R:US)
Drilling Fluids
Clay-based geothermal drilling fluids, 8:12249 (R:US)
Financing
Gladys McCall geopressured design well. Annual progress report, October 1, 1980-September 30, 1981. T-F and S/DOE Gladys McMcall No. 1 well, Cameron Parish, Louisiana, 8:12244 (R:US)
Hydraulic Fracturing
Hydraulic fracture stimulation treatment of Well Baca 23. Geothermal Reservoir Well-Stimulation Program, 8:12242 (R:US)
Site Selection
Gladys McCall geopressured design well. Annual progress report, October 1, 1980-September 30, 1981. T-F and S/DOE Gladys McMcall No. 1 well, Cameron Parish, Louisiana, 8:12244 (R:US)
Testing
Instrumentation for well tests, 8:12251 (J:US)
Well Completion
Geopressured-geothermal well report. Volume I. Drilling and completion, 8:12197 (R:US)
Well Drilling
Geopressured-geothermal well report. Volume I. Drilling and completion, 8:12197 (R:US)

GERMAN FEDERAL REPUBLIC
See FEDERAL REPUBLIC OF GERMANY

GERMANIUM
Crystal Growth
High-purity germanium crystal growing, 8:12974 (R:US)
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Proton Channeling
Angular distributions of channeled pions and protons up to 250 GeV/c, 8:13243 (J:NL)

GERMANIUM ALLOYS
Physical Radiation Effects
Effect of neutron irradiation on the critical temperature of Nb_3Ge, 8:12735 (RA:CS:In Czech)
Transition Temperature
Effect of neutron irradiation on the critical temperature of Nb_3Ge, 8:12735 (RA:CS:In Czech)

GERMANIUM COMPOUNDS
Crystal Structure
Neutron and X-ray diffraction on Nb_3Ge, 8:12780 (RA:DK:In Danish)

GERMANIUM DETECTORS
See GE SEMICONDUCTOR DETECTORS

GERMANY (FEDERAL REPUBLIC)
See FEDERAL REPUBLIC OF GERMANY

GERMS (MICROORGANISMS)
See MICROORGANISMS

GEYSERS GEOTHERMAL FIELD
Geochemical Surveys
Carbon-13 isotope values for carbon dioxide gas and dissolved carbon species in springs and wells in the Geysers-Clear Lake region, 8:12212 (RA:US)
Chemical analyses of waters from springs and wells in the Clear Lake volcanic area, 8:12209 (RA:US)
Gases from springs and wells in the Geysers-Clear Lake area, 8:12211 (RA:US)
Variability and sources of hydrogen sulfide and other gases in steam at The Geysers, 8:12210 (RA:US)
Geodetic Surveys
Monitoring crustal deformation in the Geysers-Clear Lake region, 8:12237 (RA:US)

Geologic Faults
Faulting and ore controls at the Culver-Baer mine, Sonoma County, California, 8:12196 (RA:US)
Geologic Structures
Tectonic setting of pre-tertiary rocks and its relation to geothermal resources in the Geysers-Clear Lake area, 8:12188 (RA:US)
Geophysical Surveys
Geophysical overview of The Geysers, 8:12203 (RA:US)
Geothermal Fluids
Gases from springs and wells in the Geysers-Clear Lake area, 8:12211 (RA:US)
Ground Subsidence
Monitoring crustal deformation in the Geysers-Clear Lake region, 8:12237 (RA:US)
Hydrogen Sulfides
Variability and sources of hydrogen sulfide and other gases in steam at The Geysers, 8:12210 (RA:US)
Magma Systems
Clear Lake Volcanics: tectonic setting and magma sources, 8:12189 (RA:US)
Research Programs
Research in the Geysers-Clear Lake geothermal area, northern California, 8:12187 (R:US)
Seismic P Waves
Attenuation of teleseismic P waves in the Geysers-Clear Lake region, 8:12206 (RA:US)
Large teleseismic P-wave delays in the Geysers-Clear Lake geothermal area, 8:12204 (RA:US)
Seismic Surveys
Large teleseismic P-wave delays in the Geysers-Clear Lake geothermal area, 8:12204 (RA:US)
Seismic-reflection investigations at Castle Rock Springs in the Geysers geothermal area, 8:12205 (RA:US)
Seismicity
Seismicity of the Geysers-Clear Lake region, 8:12193 (RA:US)
Tectonics
Clear Lake Volcanics: tectonic setting and magma sources, 8:12189 (RA:US)
Tectonic setting of pre-tertiary rocks and its relation to geothermal resources in the Geysers-Clear Lake area, 8:12188 (RA:US)

GIANT CELLS
See TUMOR CELLS

GIANT RESONANCE
Energy-Level Transitions
Description of giant resonance decay in quasi particle-phonon model, 8:13337 (RA:SU:In Russian)

GLASS
See also BOROSILICATE GLASS
Impact Strength
Determination of surface area of glass grains by adsorption of methylene blue and its application in the testing of relative impact strength of glasses, 8:12730 (R:IN)
Impurities
Nonphotochemical hole burning and the nature of amorphous solids (Glycerol/dimethylsulfoxide/N,N-dimethylformamide), 8:12737 (R:US)
Mechanical Properties
Failure of ceramics from multiaxial stresses. Second progress report, November 2, 1981-October 31, 1982, 8:12705 (R:US)
Physical Radiation Effects
Nonphotochemical hole burning and the nature of amorphous solids (Glycerol/dimethylsulfoxide/N,N-dimethylformamide), 8:12737 (R:US)
Waste-Rock Interactions
Release kinetics and alteration of waste glass in crystalline rock systems, 8:11915 (J:NL)

GLASS DOSEMETERS
See RPL DOSEMETERS

GLASS MELTERS
See CERAMIC MELTERS

GLUCONIC ACID
Synthesis
Design, evaluation, and application of continuous-flow cells for organic electrochemical synthesis. Final report, 8:12814 (R:US)

GLUCOPROTEINS
See also LACTOFERRIN
Biodegradation
Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture, 8:13116 (J:US)

GLUCOSE
Electrolysis
Design, evaluation, and application of continuous-flow cells for organic electrochemical synthesis. Final report, 8:12814 (R:US)
Fermentation
Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms, 8:13135 (BA:US)

GLUONS
Bound State
Evidence for glueballs, 8:13267 (R:US)
Gluonium and QCD in the J/psi region, 8:13280 (R:US)

GLYCONIC ACID
See GLUCONIC ACID

GLYCOPROTEINS
See GLUCOPROTEINS

GLYKOGENIC ACID
See GLUCONIC ACID

GOLD 197 TARGET
Carbon 12 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Neon 20 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Proton Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)

GRAIN ALCOHOL
See ETHANOL

GRAIN BOUNDARIES
Cavitation
Effects of triaxial stressing on creep cavitation of grain boundaries, 8:13402 (R:US)

GRANITES
See also GRANODIORITES
Ground Water
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Heat Flow
Effects of boundary conditions on thermomechanical calculations: Spent fuel test - climax, 8:11913 (R:US)
Heat Transfer
Experimental and calculational results from the Spent Fuel Test-Climax, 8:11854 (R:US)
Permeability
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Radiation Effects
Experimental and calculational results from the Spent Fuel Test-Climax, 8:11854 (R:US)
Radiothermoluminescence
Thermoluminescence of the mineral components in granite, 8:13216 (R:US)
Temperature Effects
Experimental and calculational results from the Spent Fuel Test-Climax, 8:11854 (R:US)
Thermal Diffusivity
Measurement of thermal diffusivity of rocks at high pressure, 8:13221 (R:US)
Thermoluminescence
Thermoluminescence of the mineral components in granite, 8:13216 (R:US)
Waste-Rock Interactions
Release kinetics and alteration of waste glass in crystalline rock systems, 8:11915 (J:NL)

GRANODIORITES
Deformation
Deformation mechanisms in granodiorite at effective pressures to 100 MPa and temperatures to partial melting, 8:13217 (R:US)
GRAPHITE
Surface Coating
Melting of two-dimensional argon film on graphite. A continuous melting, 8:12736 (RA:DK:In Danish)
GRAPHITE MODERATOR
See GRAPHITE
GRASS
See also SUGAR CANE
Energy Source Development
Forage crops can be a source of ethanol, 8:12106 (J:US)
GRASSLANDS
See RANGELANDS
GRAVIMELT PROCESS
Bench-Scale Experiments
Gravimelt process development. Quarterly technical progress report, 8:11755 (R:US)
GRAVITY SURVEYS
Performance
Subsurface subsidence damage monitoring: acoustic tomography and microgravimetry, 8:13060 (R:US)
GREAT BASIN
Geothermal Exploration
Geothermal resource exploration, 8:12216 (J:US)
GREAT BRITAIN
See UNITED KINGDOM
GREAT PLAINS
Coal Reserves
Activities in low-rank coal in the Northern Great Plains, 8:11720 (RA:US)
GREEN FUNCTION
Green's functions at zero viscosity, 8:13247 (R:US)
GREENHOUSES
See also ATTACHED GREENHOUSES
Solar Space Heating
Solar-heated greenhouse utilizing water reservoir. Final technical progress report. Appropriate-Technology Small-Grants Program, 8:12157 (R:US)
GRINDING MACHINES
Mass Transfer
Transport in rotary drums and ball mills, 8:12849 (R:DE:In German)
GROUND SOURCE HEAT PUMPS
Performance
Applicability of earth coupled heat pumps and factors affecting their performance, 8:12557 (R:US)
GROUND SUBSIDENCE
Fluid Withdrawal
Conceptual aspects of subsidence due to fluid withdrawal, 8:13201 (J:US)
Monitoring
Subsurface subsidence damage monitoring: acoustic tomography and microgravimetry, 8:13060 (R:US)
GROUND WATER
Ground-water problems in open-pit and underground mines, 8:11740 (J:US)
Chemical Composition
Geochemistry of leachates from selected coal mining and combustion wastes. Project completion report, July 1977-September 1979, 8:11692 (R:US)
Consumption Rates
Assessment of groundwater usage at Chalk Point power plant. Final report, 8:12278 (R:US)
Corrosive Effects
Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments, 8:12687 (R:US)
Fluid Flow
Physics of saturated-unsaturated subsurface flow, 8:13199 (J:US)
Geochemical Surveys
Hydrochemical and stream sediment detailed geochemical survey for Kettle Falls and Midnite Mine Areas, Washington, 8:11837 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Phoenix quadrangle, Arizona. Uranium Resource Evaluation Project, 8:11830 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Idaho Falls quadrangle, Idaho. Uranium Resource Evaluation Project, 8:11836 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Fresno and Death Valley quadrangles, California; Nevada. Uranium Resource Evaluation Project, 8:11832 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Adel, Jordan Valley, and Twin Falls quadrangles, Oregon; Idaho. Uranium Resource Evaluation Project, 8:11834 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Caliente, Lund, Ely, and Elko Quadrangles, Nevada; Utah, 8:11833 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for San Luis Obispo and Santa Cruz Quadrangles, California, 8:11831 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Hailey and Challis Quadrangles, Idaho, 8:11835 (R:US)
Precipitation
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Radionuclide Migration
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Formulation of an integrated physicochemical-hydrologic model for predicting waste-nuclide retardation in geologic media, 8:11909 (R:US)
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Solubility
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
GROUNDNUTS
See PEANUTS
GROUND-WATER RESERVES
See AQUIFERS
GROUTING
Leaching
Strontium leachability of hydrofracture grouts for sludge-slurries, 8:11866 (R:US)
Microstructure
Petrographic examination of several four-year-old laboratory developed grout mixtures, 8:12740 (R:US)
Petrography
Petrographic examination of several four-year-old laboratory developed grout mixtures, 8:12740 (R:US)
Testing
Petrographic examination of several four-year-old laboratory developed grout mixtures, 8:12740 (R:US)
GUN COTTON
See NITROCELLULOSE
GUNDREMMINGER KRB REACTOR
See RWE-BAYERNWERK REACTOR
GYROTRONS
See MICROWAVE AMPLIFIERS

H

HADRON-HADRON INTERACTIONS
General Relativity Theory
Confinement and hadron-hadron interactions by general relativistic methods, 8:13277 (R:IT)

HADRONS
Electromagnetic Particle Decay
Report on results about weak and electroweak decays of hadrons and related phenomenological Lagrangians. Progress report, 8:13273 (R:US)
Mass Difference
Research in elementary-particle physics. Progress report, May 1, 1982-April 30, 1983, 8:13250 (R:US)
Weak Particle Decay
Report on results about weak and electroweak decays of hadrons and related phenomenological Lagrangians. Progress report, 8:13273 (R:US)
HAFNIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
HALIDES
See also CHLORIDES
Molecular Structure
Halide and chalcogenide clusters of the early transition metals, 8:12784 (R:US)
HALL GENERATORS
See MHD GENERATORS
HALTHANE
Curing
Curing behavior of seven segmented polyurethane adhesives, 8:12728 (R:US)
HANDLING (MATERIALS)
See MATERIALS HANDLING
HANFORD RESERVATION
Radiation Accidents
1976 Hanford americium exposure incident: overview and perspective, 8:13142 (R:US)
1976 Hanford americium exposure incident: psychological aspects, 8:13144 (R:US)
1976 Hanford americium exposure incident: organ burden and radiation dose estimates, 8:13148 (R:US)
Radiation Monitoring
Characteristics of airborne plutonium resuspended from near-background aged surface-sources, 8:13047 (R:US)
HARMONIC OSCILLATORS
Three-Body Problem
Three-particle relativistic harmonic dynamics in the constraint formalism, 8:13279 (R:JP)
HARMONIC POTENTIAL
Analytical Solution
Coherent states with classical motion: from an analytic method complementary to group theory, 8:13407 (R:US)
HARVESTING
Cost
Different perspective, 8:12088 (RA:US)
HASTELLOY X
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
HAWAII
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
HAYNES 188 ALLOY
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
HAYNES STELLITE 6B
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
HAZARDOUS MATERIALS
Not for radioactive materials.
Waste Disposal
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
H-COAL PROCESS
Catalysts
Coal-liquefaction catalyst development. Annual report No. 1, April 1, 1979-June 30, 1980, 8:11617 (R:US)
Engineering
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Pumps
Vibration monitoring of ebullating pump at the H-Coal pilot plant, 8:11624 (R:US)
HD 8077
See NICKEL BASE ALLOYS
HE-3 COUNTERS
Response Functions
Energy dependence of the response of a ^{3}He long counter, 8:12998 (J:NL)
HEALTH HAZARDS
Quality Assurance
Approach to E, S, and H assurance programs for institutions. Volume II. Line-organization functions, 8:12469 (R:US)
Risk Assessment
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Session X: regulatory risk assessment, 8:13187 (BA:US)
HEALTH PHYSICS
See RADIATION PROTECTION
HEALTH PHYSICS RESEARCH REACTOR
See HPRR REACTOR
HEAT DISSIPATION
See ENVIRONMENTAL TRANSPORT
HEAT DISTRIBUTION SYSTEMS
Mathematical Models
A model for optimal design of district heating networks, 8:12641 (R:US)
Optimization
A model for optimal design of district heating networks, 8:12641 (R:US)
HEAT EXCHANGERS
See also RADIATORS
Cleaning
Heat exchanger cleaning in support of ocean thermal energy conversion (OTEC) - electronics subsystems, 8:12129 (R:US)
Heat exchanger cleaning in support of ocean thermal energy conversion (OTEC) - mechanical subsystem, 8:12130 (R:US)
Heat Transfer
Study of heat and mass transfer in a vertical-tube evaporative cooler, 8:12614 (R:US)
Mass Transfer
Study of heat and mass transfer in a vertical-tube evaporative cooler, 8:12614 (R:US)
Performance Testing
Evaluation of a heat exchanger for use in the Integrated Equipment Test facility solvent-extraction system, 8:11848 (R:US)
HEAT PUMPS
See also AIR SOURCE HEAT PUMPS
GROUND SOURCE HEAT PUMPS
SOLAR-ASSISTED HEAT PUMPS
WATER SOURCE HEAT PUMPS
Design
Development and demonstration of an electric heat pump for waste-heat recovery in industry. Preliminary design report, 8:12621 (R:US)
Tubes
Short-tube refrigerant-flow restrictors, 8:12556 (R:US)
Waste Heat Utilization
Development and demonstration of an electric heat pump for waste-heat recovery in industry. Preliminary design report, 8:12621 (R:US)
Working Fluids
Development and demonstration of an electric heat pump for waste-heat recovery in industry. The selection of working-fluid candidates for use in high-temperature industrial heat

pumps. Topical report, September 1977-December 1978, 8:12620 (R:US)
Heat driven heat pump using paired ammoniated salts, 8:12581 (P:US)

HEAT RECOVERY EQUIPMENT
Performance
Waste-heat vertical tube foam evaporation for cooling tower blowdown renovation/recycle. Project summary report, 8:12277 (R:US)

HEAT SOURCES (RADIOISOTOPE)
See RADIOISOTOPE HEAT SOURCES

HEAT STORAGE DEVICES
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT STORAGE SYSTEMS
See THERMAL ENERGY STORAGE EQUIPMENT

HEATER OIL
See HEATING OILS

HEATERS
See also WATER HEATERS
Heat Transfer
Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982, 8:11638 (R:US)
Multiphase Flow
Thermal-hydrodynamic data analysis and correlation: PETC coal-liquefaction preheater test loop. Technical progress report, April 1981-March 1982, 8:11638 (R:US)

HEATING OILS
Rate Structure
Rate guide for commercial No. 2 heating oil and coal, 8:11781 (R:US)
Retail Prices
Rate guide for commercial No. 2 heating oil and coal, 8:11781 (R:US)

HEATING SYSTEMS
See also SOLAR HEATING SYSTEMS
Refuse-Fueled Boilers
A field test using DRDF in a spreader stoker hot water generator. Final report Sep 80-Jul 81, 8:12891 (R:US)

HEAVY FUELS
See RESIDUAL FUELS

HEAVY ION ACCELERATORS
Includes combined accelerator types for heavy ion acceleration.
Electromagnetic Isotope Separators
Isotopic separation device on-line with a heavy ion accelerator, 8:12926 (R:FR:In French)
Reliability
Advanced medical accelerator design, 8:12925 (R:US)

HEAVY ION REACTIONS
See also BERYLLIUM 9 REACTIONS
BORON 10 REACTIONS
BORON 11 REACTIONS
CARBON 12 REACTIONS
LITHIUM 7 REACTIONS
NEON 20 REACTIONS
NITROGEN 14 REACTIONS
NITROGEN 15 REACTIONS
OXYGEN 16 REACTIONS
Accelerator Facilities
4 π physics with the plastic ball, 8:13297 (R:US)
Fragmentation
Facility for measurements of fragmentation spectra of relativistic deuterons and alpha particles, 8:12921 (R:SU:In Russian)
Nuclear Deformation
Nuclear-deformation energies according to a liquid-drop model with a sharp surface, 8:13335 (R:US)
Pair Production
Research in theoretical physics. Annual progress report, April 1, 1982-March 31, 1983, 8:13286 (R:US)
Phase Transformations
Research in theoretical physics. Annual progress report, April 1, 1982-March 31, 1983, 8:13286 (R:US)
Research Programs
Physics Division annual review, 1 April 1980-31 March 1981, 8:13293 (R:US)

HEAVY LEPTONS
See also TAU PARTICLES
Pair Production
Topics in phenomenology of unified gauge theories of weak, electromagnetic, and strong interactions, 8:13289 (R:US)

HEAVY NUCLEI
For nuclei from mass 181 upwards.
See also ACTINIDE NUCLEI
ASTATINE 210
ASTATINE 211
BISMUTH 207
BISMUTH 211
FRANCIUM 212
LEAD 205
LEAD 208
LEAD 210
LEAD 211
POLONIUM 209
RADIUM 213
RADIUM 226
RADON 211
RADON 222
RADON 226
THALLIUM 201
THALLIUM 205
Collective Excitations
Nonlinear response and collective motion in nuclei at large amplitudes in time-dependent Hartree-Fock approximation, 8:13365 (RA:SU:In Russian)
Fission
Average values and dispersions of fission fragment kinetic energies in terms of "touching fragments" model (^{226}Ra, ^{236}U, ^{240}Pu, ^{252}Cf, ^{256}Fm, ^{256}No, ^{260}Ku, ^{260}106, ^{286}112, ^{292}116), 8:13350 (RA:SU:In Russian)
Resonance
Usage of the sum rules for a systematics of the analog and Gamow-Teller resonances in the self-consistent theory of the finite Fermi systems, 8:13358 (RA:SU:In Russian)

HEAVY OILS
See PETROLEUM

HEBER GEOTHERMAL FIELD
Geothermal Power Plants
Implications of the California Public Utilities Commission's decision on the proposed Southern California Edison/Chevron Resources Power Plant at Heber, California, 8:12225 (RA:US)
Gravity Surveys
Repetitive precision gravity studies at the Cerro Prieto and Heber geothermal fields, 8:12201 (R:US)

HECTORITE
See MONTMORILLONITE

HELIANTHUS ANNUUS
See SUNFLOWERS

HELIOSTATS
See also SOLAR TRACKING SYSTEMS
Protective Coatings
Uv protective coatings for heliostats and the plastic dome. Final technical report, 8:12119 (R:US)
Washing
Heliostat washing equipment requirements (RADL Item 7-17). 10-MWe solar-thermal central-receiver pilot plant: solar facilities design integration, 8:12120 (R:US)
Weathering
Uv protective coatings for heliostats and the plastic dome. Final technical report, 8:12119 (R:US)

HELIUM 3 REACTIONS
Stripping
^{27}Al(p,γ)^{28}Si and ^{27}Al(^{3}He,d)^{28}Si to the stretched 11.58-MeV (6$^-$,0) and 14.36-MeV (6$^-$,1) levels, 8:13316 (R:US)

HELIUM 3 TARGET
Electron Reactions
Koltun sum rules testing in the (e, e'p) experiments on ^{3}He and ^{4}He, 8:13300 (RA:SU:In Russian)
Two-particle electro-disintegration of ^{3}He in a microscopic approach, 8:13301 (RA:SU:In Russian)
Neutron Reactions
Algebraic version of resonating-group method and elastic scattering plases of the ^{3}He(n, n)^{3}He, ^{3}H(p, p)^{3}H, ^{2}H(d, d)^{2}H, 8:13299 (RA:SU:In Russian)

HELIUM 4 REACTIONS
See ALPHA REACTIONS

HELIUM 4 TARGET
Electron Reactions
Koltun sum rules testing in the (e, e'p) experiments on ^{3}He and ^{4}He, 8:13300 (RA:SU:In Russian)
HELIUM 6
Ground States
Detailed investigation of ground state structure of ^{6}Li-^{6}He-^{6}Be nuclei, 8:13307 (RA:SU:In Russian)
HELIUM DILUTION REFRIGERATORS
Design
Closed cycle cryocooler for low temperature electronic circuits. Phase II. Preliminary design. Final report 15 May-30 Sep 81, 8:12837 (R:US)
HELIUM I
The phase of liquid helium-4 which is stable at temperatures above the lambda point (about 2.2 K).
Nuclear Superheating
Superheating limits of liquid helium I, 8:13249 (J:GB)
HETEROCYCLIC COMPOUNDS
See also THIONAPHTHENES
Gas Chromatography
Separation of asphaltenes using high-resolution supercritical-fluid chromatography. Progress report, September 1-November 30, 1982 (Heterocyclic aromatic nitrogen compounds), 8:12750 (R:US)
Phosphorescence
Solid-surface luminescence analysis. Progress report, June 1980-October 1982, 8:12804 (R:US)
HEXANOLS
Phase Studies
Liquid crystals and microemulsions in oil recovery, 8:11801 (J:US)
HEXYL ALCOHOLS
See HEXANOLS
HGI2 SEMICONDUCTOR DETECTORS
Efficiency
Recent developments in thick mercuric iodide spectrometers, 8:12946 (R:US)
Electrical Properties
Characterization of single-crystal mercuric iodide (HgI_2) using thick detector structures, 8:12731 (R:US)
Energy Resolution
Recent developments in thick mercuric iodide spectrometers, 8:12946 (R:US)
HIGH ALTITUDE (STRATOSPHERE)
See STRATOSPHERE
HIGH BTU GAS
Over 900 Btu/ft^3.
Production
Continued development of a peat biogasification process, 8:11607 (RA:US)
HIGH ENERGY PHYSICS
Use only for articles of a very broad nature such as an annual research program, etc.
Physics of atoms and elementary particles. Semantic collection of scientific papers, 8:13251 (R:SU:RU)
Meetings
Novel results in particle physics, 8:13252 (B:US)
Research Programs
Annual report, 1981. Cosmic and subatomic physics, elementary particle physics, mathematical physics, and theoretical high energy physics, 8:13226 (R:SE)
Experimental and theoretical nuclear physics. Final report, 8:13292 (R:US)
Report of activity, 8:12471 (R:FR:FR)
Research in elementary-particle physics. Progress report, May 1, 1982-April 30, 1983, 8:13250 (R:US)
HIGH ENERGY RADIOTHERAPY
See RADIOTHERAPY
HIGH EXPLOSIVES
See CHEMICAL EXPLOSIVES
HIGH TEMPERATURE GAS COOLED AND GRAPHITE
See HTGR TYPE REACTORS
HIGH-BETA PLASMA
Beta from 0.1 to 1.
Magnetic Probes
Efficient technique for magnetic analysis of non-circular, high-beta tokamak equilibria, 8:13505 (J:AT)
HIGH-FREQUENCY HEATING
See also ECR HEATING
ICR HEATING
Coupling
Simplifying theorem for analyzing rf antennas with feeders, 8:13475 (R:US)
HIGH-LEVEL RADIOACTIVE WASTES
Leaching
Analysis of waste-package behavior for high-level waste, 8:11910 (R:US)
Packaging
Analysis of waste-package behavior for high-level waste, 8:11910 (R:US)
Retrieval Systems
Background and historical perspectives for monitored retrievable storage, 8:11856 (J:US)
HIGHLY ENRICHED URANIUM
80 - 100 per cent.
Exports
Obstacles to US ability to control and track weapons-grade uranium supplied abroad, 8:11936 (R:US)
Information Systems
Obstacles to US ability to control and track weapons-grade uranium supplied abroad, 8:11936 (R:US)
Safeguards
Obstacles to US ability to control and track weapons-grade uranium supplied abroad, 8:11936 (R:US)
HIGH-PURITY GE DETECTORS
Fabrication
High-purity germanium crystal growing, 8:12974 (R:US)
HIGH-TEMPERATURE FUEL CELLS
See also MOLTEN CARBONATE FUEL CELLS
Electrochemistry
Concentration cells for combustion improvement. Final report on reaction rate in a zirconium-yttria solid-electrolyte fuel cell, 8:12521 (R:US)
Performance Testing
Concentration cells for combustion improvement. Final report on reaction rate in a zirconium-yttria solid-electrolyte fuel cell, 8:12521 (R:US)
HK 40
See ALLOY-HK-40
HO2
See HYDROPEROXY RADICALS
HODOSCOPES
Design
Forward dimuons from πN interactions at Fermilab: design and construction of a scintillation-counter hodoscope, 8:13278 (R:US)
HOG FUEL
See WOOD WASTES
HOLMIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
HOPPERS
Design
Research and development leading to the preparation of a gravity flow of solids media engineering databook for coal conversion and utilization processes. Phase I. Final technical report, 8:11752 (R:US)
HOSE INSTABILITY
Instability Growth Rates
Gaussian-profile beams, 8:12908 (R:US)
HOSPITALS
Photovoltaic Power Supplies
Intermediate photovoltaic system application experiment operational performance report. Volume 4. For G.N. Wilcox Memorial Hospital, Kauai, Hawaii for June, July, and August 1982, 8:12112 (R:US)
HOT CELLS
Manipulators
Advanced servomanipulator performance summary. Consolidated Fuel-Reprocessing Program, 8:12843 (R:US)
Servomotor test stand. Consolidated Fuel-Reprocessing Program, 8:12844 (R:US)

HOT GAS CLEANUP
Chemical Reaction Kinetics
Systems model of the iron oxide hot-gas clean-up process. Volume 1. Theoretical and experimental results. Final report, September 1979-December 1980, 8:11660 (R:US)
Computerized Simulation
Systems model of the iron oxide hot gas clean-up process. Volume II. Hotgas user's manual. Final report, September 1979-December 1980, 8:11661 (R:US)
Mathematical Models
Systems model of the iron oxide hot-gas clean-up process. Volume 1. Theoretical and experimental results. Final report, September 1979-December 1980, 8:11660 (R:US)
HOT PLASMA
Particle Beams
Scattering of a particle beam by a non-equilibrium plasma, 8:13462 (J:GB)
HOT WATER HEATERS
See WATER HEATERS
HOT-DRY-ROCK SYSTEMS
Directional Drilling
Unique aspects of drilling and completing hot-dry-rock geothermal wells, 8:12246 (R:US)
Fractured Reservoirs
Los Alamos hot-dry-rock project: recent results, 8:12245 (R:US)
HOUSEHOLDS
Energy Expenses
Technology assessment of solar energy systems. Socioeconomic impacts of solar deployment and conventional energy use. Volume III, 8:12020 (R:US)
HOUSES
Air Infiltration
Measured effect of forced ventilation on house infiltration rate, 8:12559 (R:US)
Cooling Systems
Demonstration ice storage with waste-heat-recovery project. Final report, 8:12570 (R:US)
Energy Audits
Overcoming barriers to residential conservation: do energy audits help, 8:12567 (R:US)
Energy Conservation
Barriers to household investment in residential energy conservation: preliminary assessment, 8:12566 (R:US)
Residential comfort-conditioning options for the Texas Gulf Coast. Final report, 8:12577 (R:US)
Energy Consumption
First year's performance data of the NCSU Solar Energy and Conservation House, 8:12134 (R:US)
Passive Solar Cooling Systems
Passive-solar homes for Texas, 8:12173 (R:US)
Passive Solar Heating Systems
Passive-solar homes for Texas, 8:12173 (R:US)
Solar Water Heaters
Performance and reliability of residential solar water heaters, 8:12138 (RA:US)
Ventilation
Measured effect of forced ventilation on house infiltration rate, 8:12559 (R:US)
HPRR REACTOR
Neutron Reactions
Dose levels and neutron reaction rates for HPRR and SHEBA, 8:12438 (J:US)
Radiation Dose Distributions
Dose levels and neutron reaction rates for HPRR and SHEBA, 8:12438 (J:US)
Reactor Operation
Health Physics Research Reactor operating history and recent improvements, 8:12379 (J:US)
HTGR TYPE REACTORS
See also AVR REACTOR
Economics
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Reactor Components
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)
Reactor Operation
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
HTO
See TRITIUM COMPOUNDS
HUGENHOLTZ-PINES THEORY
See HYDROGEN
HUMAN CELLS
See ANIMAL CELLS
HUMAN FACTORS ENGINEERING
Technical note: handling of alarms using logic, 8:12362 (J:US)
HUMAN POPULATIONS
See also MINORITY GROUPS
Behavior
Leadership opportunities in the new age, 8:13099 (R:US)
Life Styles
Leadership opportunities in the new age, 8:13099 (R:US)
Mortality
Selected epidemiological observations of cell-specific leukemia mortality in the USA, 1969-1977, 8:13138 (R:US)
Radiation Doses
Radiation-induced risk of resettling Bikini atoll. Final report, November 7, 1981-May 28, 1982, 8:13140 (R:US)
Radiation Hazards
Review of dosimetry for the atomic bomb survivors, 8:13158 (J:US)
HUMANS
See HUMAN POPULATIONS
HUMIC ACIDS
Flocculation
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
HUMIDITY
Data Compilation
January 1980 environmental data for sites in the National Solar Data Network, 8:12013 (R:US)
HUTCHINSON ISLAND-1 REACTOR
See LUCIE-1 REACTOR
HYBRID ELECTRIC-POWERED VEHICLES
Performance
Analysis and comparison of automotive-propulsion systems, 8:12643 (R:US)
HYBRID REACTORS
Fuel Cycle
A care inventory model for fuel trajectory analysis in fusion-fission symbiotic systems, 8:13521 (J:US)
Sensitivity Analysis
Cross-section sensitivity analysis for a tandem mirror hybrid reactor and considerations regarding new ^{9}Be (n, 2n) cross-section evaluations, 8:13520 (J:US)
HYDRAULIC RAMS
See PUMPS
HYDRAULICS
Computer Calculations
Entry format for representation of analytical relations on the ES computer, 8:13549 (R:SU:In Russian)
HYDROCARBON FUEL CELLS
Cogeneration
Fuel cell cogeneration in the wastewater treatment industry, 8:12543 (BA:US)
HYDROCARBONS
See also ALKANES
ALKENES
ANTHRACENE
BENZENE
NAPHTHALENE
PHENANTHRENE
POLYCYCLIC AROMATIC HYDROCARBONS
PYRENE
TETRACENE
Air Pollution Abatement
Plasma-jet ignition in a lean-burn CFR engine, 8:12645 (R:US)

Synthesis
Liquid-hydrocarbon fuels from syngas. Quarterly report, March 1982-May 1982, 8:11963 (R:US)

HYDROCHLORIC ACID
Distillation
Pt. 3. Acid separation, 8:11886 (RA:XE:In German)
Recycling
Pt. 3. Acid separation, 8:11886 (RA:XE:In German)

HYDROCRACKING
Catalysts
Development of new catalysts for coal liquids refining. Final report, January 1979-April 1981, 8:11615 (R:US)

HYDROCYCLONES
See CYCLONE SEPARATORS

HYDRODYNAMIC MODEL
Equations of Motion
Corrections to nuclear hydrodymamics, due to dynamical deformation of the Fermi surface, 8:13364 (RA:SU:In Russian)
Fermi Level
Corrections to nuclear hydrodymamics, due to dynamical deformation of the Fermi surface, 8:13364 (RA:SU:In Russian)

HYDROELECTRIC POWER
Energy resources in California, 8:12483 (R:US)

HYDROELECTRIC POWER PLANTS
See also LOW-HEAD HYDROELECTRIC POWER PLANTS
PUMPED STORAGE POWER PLANTS
SMALL-SCALE HYDROELECTRIC POWER PLANTS
Electric Generators
Doubly fed machine review: agenda. Conference report, Washington, DC, 8:12263 (R:US)

HYDROELECTRICITY
See HYDROELECTRIC POWER

HYDROGEN
Chemical Reaction Kinetics
Kinetics of the reduction of calcium sulfate with carbon monoxide and hydrogen, 8:12787 (R:US)
Chemisorption
H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R:US)
Combustion Kinetics
Effect of surface chemistry on the development of the [OH] in a combustion boundary layer, 8:11958 (RA:US)
Consumption Rates
Integrated two-stage liquefaction. Topical technical progress report completion of Indiana V program, April 1, 1981-September 30, 1981, 8:11618 (R:US)
Dielectric Properties
Materials research for hydrogen-cooled superconducting power-transmission lines (SPTL). Part I. Liquid hydrogen as a dielectric. Part II. Superconducting materials. Annual report, January 1, 1981-December 31, 1981, 8:12668 (R:US)
Diffusion
Hydrogen and deuterium diffusion in vanadium alloys (Containing Ti or Nb), 8:12676 (R:US)
Fermentation
Clostridium thermoautotrophicum species novum, a thermophile producing acetate from molecular hydrogen and carbon dioxide, 8:12105 (J:US)
Flammability
Effect of water fogs on the deliberate ignition of hydrogen. Final report, 8:12831 (R:US)

HYDROGEN 1 TARGET
Polarized Targets
System for measuring of proton polarization in polarized target, 8:12924 (R:SU:In Russian)

HYDROGEN 2
See DEUTERIUM

HYDROGEN 3
See TRITIUM

HYDROGEN CHLORIDES
See HYDROCHLORIC ACID

HYDROGEN DONOR REACTIONS
See HYDROGEN TRANSFER

HYDROGEN HYDROXIDES
See WATER

HYDROGEN IONS 1 MINUS
For H_1^- ions.
Polarized Beams
Application of the electron-cyclotron resonance source to Lamb-shift polarized ion sources, 8:13235 (R:US)

HYDROGEN NITRATES
See NITRIC ACID

HYDROGEN PRODUCTION
A high-temperature fusion blanket for synfuel and electrical production, 8:13519 (J:US)
Biophotolysis
Engineering analysis of potential photosynthetic bacterial hydrogen-production systems, 8:11956 (R:US)
Thermochemical Processes
High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982, 8:12057 (R:US)

HYDROGEN SULFATES
See SULFURIC ACID

HYDROGEN TRANSFER
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Final progress report, February 1980-July 1982, 8:11628 (R:US)
Inhibition
Control of proton efflux from corn root tissue by an injury-sensing mechanism, 8:13121 (J:NL)

HYDROGENATION
Catalysts
Development of new catalysts for coal liquids refining. Final report, January 1979-April 1981, 8:11615 (R:US)
Integrated two-stage liquefaction. Topical technical progress report completion of Indiana V program, April 1, 1981-September 30, 1981, 8:11618 (R:US)
Liquid-hydrocarbon fuels from syngas. First annual report, March 1981-February 1982, 8:11962 (R:US)
New catalysts for coal-liquid upgrading. Quarterly report, September 1-December 31, 1982, 8:11637 (R:US)
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)
Synthetic fuels industry in Germany 1927 to 1945, 8:11778 (RA:US)
Wilsonville Advanced Coal-Liquefaction Research and Development Facility, Wilsonville, Alabama: Run 240 with Illinois 6 coal. Technical progress report (Run 240; non-integrated two stage), 8:11641 (R:US)

HYDROLOGY
Mathematical Models
Contaminant migration in saturated unconsolidated geologic deposits, 8:13200 (J:US)
Numerical modeling in hydrology, 8:13205 (J:US)
Meetings
Recent trends in hydrogeology, 8:13198 (B:US)

HYDROPEROXY RADICALS
HO2
Research Programs
Nature of oxygen-containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, July 1981-June 1982, 8:12820 (R:US)

HYDROXYL RADICALS
Chemical Reaction Yield
ESR study of the attack of photolytically produced hydroxyl radicals on α-methyl-D-glucopyranoside in aqueous solution, 8:12822 (J:US)
Fluorescence Spectroscopy
Effect of surface chemistry on the development of the [OH] in a combustion boundary layer, 8:11958 (RA:US)
Oxidation
Effect of surface chemistry on the development of the [OH] in a combustion boundary layer, 8:11958 (RA:US)
Recombination
Effect of surface chemistry on the development of the [OH] in a combustion boundary layer, 8:11958 (RA:US)
Research Programs
Nature of oxygen-containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, July 1981-June 1982, 8:12820 (R:US)

HYDROXYLAMINE
Oxidation
Oxidation of hydroxylamine by nitrous and nitric acid, 8:12808 (J:US)
HYDROXYNAPHTHALENES
See NAPHTHOLS
HYLIFE CONVERTER
High Yield Lithium Injection Fusion Energy Converter.
First Wall
Research on the HYLIFE liquid-first-wall concept for future laser-fusion reactors: liquid jet impact experiments. Final report No. 8, 8:13496 (R:US)
HYPERFRAGMENTS
See HYPERNUCLEI
HYPERNUCLEI
Binding Energy
Contribution of the S' state in Bsub(lambda)(sub(lambda)sup(3)H), 8:13298 (RA:SU:In Russian)
HYPERONS
Particle Production
Charged-hyperon production by 400-GeV/c protons, 8:13260 (R:US)
HYPERTONIC SOLUTIONS
Biological Effects
Control of proton efflux from corn root tissue by an injury-sensing mechanism, 8:13121 (J:NL)
HYTORT PROCESS
Economics
Synthetic fuels from US oil shales: a technical and economic verification of the HYTORT process. Final report (incorporates fourth quarterly report), January 1-March 31, 1981, 8:11825 (R:US)
Feasibility Studies
Synthetic fuels from US oil shales: a technical and economic verification of the HYTORT process. Final report (incorporates fourth quarterly report), January 1-March 31, 1981, 8:11825 (R:US)

I

IAEA
Nuclear Data Collections
Index of nuclear data libraries available from the IAEA Nuclear Data Section, 8:13571 (R:XA)
IAEA SAFEGUARDS
Nondestructive Analysis
Inventory-sample coincidence-counter manual, 8:11939 (R:US)
ICHTHYOPLANKTON
Entrainment
Occurrence of American shad eggs in 1G cooling-water canal, 8:13096 (R:US)
Sedimentation
Occurrence of American shad eggs in 1G cooling-water canal, 8:13096 (R:US)
ICR HEATING
Antennas
Spheromak ICRF heating studies at low power, 8:13439 (R:US)
Coupling
ICRF antenna coupling studies, 8:13478 (R:US)
IDAHO
Geochemical Surveys
Hydrogeochemical and stream-sediment reconnaissance basic data for Idaho Falls quadrangle, Idaho. Uranium Resource Evaluation Project, 8:11836 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Adel, Jordan Valley, and Twin Falls quadrangles, Oregon; Idaho. Uranium Resource Evaluation Project, 8:11834 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Hailey and Challis Quadrangles, Idaho, 8:11835 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Natural Gas Deposits
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R:US)
Petroleum Deposits
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R:US)
Uranium Deposits
Hydrogeochemical and stream-sediment reconnaissance basic data for Adel, Jordan Valley, and Twin Falls quadrangles, Oregon; Idaho. Uranium Resource Evaluation Project, 8:11834 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Hailey and Challis Quadrangles, Idaho, 8:11835 (R:US)
IDAHO NATIONAL ENGINEERING LABORATORY
Prior to 1976 known as NRTS and older material is so indexed.
Earthquakes
Earthquake catalog for the eastern Snake River Plain region, Idaho (43.0°-44.5°N, 111.5°-114.0°W), October 1972-June 1982, 8:13209 (R:US)
Reactor Accidents
Degraded core studies at INEL, 8:12434 (J:US)
IDEAL FLOW
Turbulence
Green's functions at zero viscosity, 8:13247 (R:US)
IEUS
Acid Electrolyte Fuel Cells
Develop and test fuel-cell-powered on-site integrated total-energy systems: Phase III, full-scale power plant development. 5th quarterly report, February-April, 1982, 8:12522 (R:US)
IGNITION SYSTEMS
Performance
Plasma-jet ignition in a lean-burn CFR engine, 8:12645 (R:US)
ILLINOIS
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Radioactive Waste Facilities
Low-level radioactive waste disposal: commercial facilities no longer operating, 8:11871 (RA:US)
Small-Scale Hydroelectric Power Plants
Phase I report: inventory of potential small-scale hydropower sites in Illinois and selection of projects exhibiting potential for development. Final report, 8:11994 (R:US)
Small scale hydropower development in Illinois: an implementation manual. Final report, 8:11993 (R:US)
ILLINOIS BASIN
Geographically, an area that includes all the coal reserves of Illinois, Indiana, and the western part of Kentucky.
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
ILLITE
Sorptive Properties
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
IMPACT TESTS
Data Analysis
Evaluation and control of conservatism in drop-table shock tests, 8:12883 (R:US)
IMPERFECTIONS
See DEFECTS

IMPERMEABLE DRY ROCK
See HOT-DRY-ROCK SYSTEMS
IMPURITIES
Unwanted constituents, not for TRACE AMOUNTS, INTERFERING ELEMENTS, or metal and nonmetal additions.
Emission Spectra
Spectroscopic studies of impurity control in coaxial sources for spheromaks at Los Alamos, 8:13437 (R:US)
IN-BEAM SPECTROSCOPY
Data Acquisition Systems
Development of data-acquisition-and-analysis systems for in-beam gamma-ray spectroscopy: a study of the nucleus ^{180}W, 8:13343 (R:US)
Data Analysis
Development of data-acquisition-and-analysis systems for in-beam gamma-ray spectroscopy: a study of the nucleus ^{180}W, 8:13343 (R:US)
INCIDENTS
See ACCIDENTS
INCINERATION
See COMBUSTION
INCINERATORS
See also WATERWALL INCINERATORS
Gaseous Wastes
Radioactive-waste incineration at Purdue University, 8:11872 (R:US)
Materials Testing
Pilot solid-waste incinerator, 8:11877 (R:US)
Off-Gas Systems
Pilot solid-waste incinerator, 8:11877 (R:US)
Performance Testing
Pilot solid-waste incinerator, 8:11877 (R:US)
SRL incinerator components test facility, 8:11876 (R:US)
INCLUSION COMPLEXES
See CLATHRATES
INCOLOY 800
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
INCOMPRESSIBLE FLOW
Computer Codes
CONVEC: a computer program for transient incompressible fluid flow based on quadratic finite elements. Part 1: theoretical aspects, 8:13248 (R:XE)
Flow Rate
Experimental and numerical studies of natural convection in a Hele-Shaw cell, 8:12873 (R:US)
Heat Transfer
CONVEC: a computer program for transient incompressible fluid flow based on quadratic finite elements. Part I. Theoretical aspects, 8:12868 (R:XE)
Natural Convection
Experimental and numerical studies of natural convection in a Hele-Shaw cell, 8:12873 (R:US)
INCONEL 600
Corrosion
Corrosion rates and evaluations of structural materials on the North Atlantic Continental Rise, 8:12683 (R:US)
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
INCONEL 671
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
IN-CORE FUEL MANAGEMENT
See FUEL MANAGEMENT
INDIA
Coal Deposits
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals, 8:11725 (RA:US)
Coal Reserves
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals, 8:11725 (RA:US)
Meteorology
MONEX79 atmospheric boundary-layer experiment over the Bay of Bengal: Digha data report, 8:13019 (R:US)
INDIANA
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
INDIGO
$C_1H_{19}Ovv.$
Voltametry
Voltametric study of indigo red, 8:12773 (TJ:US)
INDIGO RED
See INDIGO
INDIUM 110
Energy-Level Density
Parameter of nuclear level density spin dependence in the range A approximately 100, 8:13332 (RA:SU:In Russian)
INDIUM 113 TARGET
Neutron Reactions
Direct process contribution into the hard component of the ^{113}In(n,n') reaction spectra, 8:13324 (RA:SU:In Russian)
INDIUM 117
Energy-Level Density
Parameter of nuclear level density spin dependence in the range A approximately 100, 8:13332 (RA:SU:In Russian)
INDIUM ARSENIDES
Doping and transport studies in In/sub x/Ga/sub 1-x/As/GaAs strained-layer superlattices, 8:12741 (R:US)
INDIUM OXIDES
Photoconductivity
Dynamic aspects of the dye-sensitized photoconductivity of semiconductors. Technical progress report, April 1, 1981-March 31, 1983, 8:12733 (R:US)
INDUSTRIAL LAUNDRIES
See LAUNDRIES
INDUSTRIAL PLANTS
See also CHEMICAL PLANTS
COAL GASIFICATION PLANTS
COAL LIQUEFACTION PLANTS
COAL PREPARATION PLANTS
DESALINATION PLANTS
ETHANOL PLANTS
FEED MATERIALS PLANTS
ISOTOPE SEPARATION PLANTS
METHANOL PLANTS
PETROLEUM REFINERIES
WASTE PROCESSING PLANTS
Air Pollution Control
Bubbles, existing and new under the Clean Air Act (Compliance based on total plant emission rather than limits on each boiler), 8:13051 (RA:US)
Boiler Fuels
Conversion of an industrial boiler to Coal-Oil Mixture, 8:11761 (RA:US)
Industrial coal utilization: fourth annual symposium, 8:11780 (R:US)
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Regulatory constraints on industrial coal utilization, 8:11764 (RA:US)
Chemical Feedstocks
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Cogeneration
Carbonate fuel cell system development for industrial cogeneration. Final report Mar 80-Aug 81, 8:12524 (R:US)
Energy Conservation
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Energy Supplies
Alternatives of the industrial energy planner, 8:12616 (RA:US)
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)

Fuel Substitution
Feasibility study of a Texas lignite-gasification facility to fuel: a small industrial plant. Final report, 8:11785 (R:US)
Planning
Alternatives of the industrial energy planner, 8:12616 (RA:US)
Radiation Protection
Supplemental stack-effluent monitoring at the Safety Light Corporation, Bloomsburg, Pennsylvania. Final report, 8:13037 (R:US)
Site Selection
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Solar Process Heat
Solar-augmented applications in industry. Phase II: conceptual designs, volume 1. Final report Jun 80-Dec 81, 8:12166 (R:US)

INDUSTRIAL SECTOR
See INDUSTRY

INDUSTRIALIZED COUNTRIES
See DEVELOPED COUNTRIES

INDUSTRY
See also AGRICULTURE
AUTOMOTIVE INDUSTRY
CHEMICAL INDUSTRY
COAL INDUSTRY
CONSTRUCTION INDUSTRY
GEOTHERMAL INDUSTRY
METAL INDUSTRY
NATURAL GAS INDUSTRY
NUCLEAR INDUSTRY
OIL SHALE INDUSTRY
PETROLEUM INDUSTRY
RUBBER INDUSTRY
SOLAR INDUSTRY
SYNTHETIC FUELS INDUSTRY
Cogeneration
Role of fuel cells in industrial cogeneration, 8:12542 (BA:US)
Energy Conservation
Energy efficient industrial technology in Europe: a compendium. Interim report May 79-Feb 82, 8:12625 (R:US)
Third-party financing: increasing investment in energy-efficient industrial projects, 8:12618 (R:US)
Energy Consumption
Michigan energy futures: requirements to the year 2000, 8:12482 (R:US)
Energy Demand
Role of fuel cells in industrial cogeneration, 8:12542 (BA:US)
Manpower
Training farmworkers for industrial jobs: a longitudinal study, 8:12466 (R:US)

INERTIAL CONFINEMENT
A dynamic plasma confinement by inertial forces.
Research Programs
1981 inertial fusion research annual technical report, 8:13471 (R:US)

INHIBITORS (ENZYME)
See ENZYME INHIBITORS

INJURIES
Biological Effects
Control of proton efflux from corn root tissue by an injury-sensing mechanism, 8:13121 (J:NL)

INORGANIC ACIDS
See also HYDROCHLORIC ACID
NITRIC ACID
SULFURIC ACID
Ion Exchange Chromatography
Applications of ion chromatography (Fluoroboric acid), 8:12747 (R:US)

INSECTS
Behavior
Biological impacts of alcohol fuel emission on selected pollinator, predatory and nutrient-cycling insects and arachnids, 8:13177 (RA:BR)
Biological Functions
Biological impacts of alcohol fuel emission on selected pollinator, predatory and nutrient-cycling insects and arachnids, 8:13177 (RA:BR)

IN-SITU GASIFICATION
Cavities
Overburden characterization and post-burn study of the Hoe Creek, Wyoming underground coal gasification site and comparison with the Hanna, Wyoming site, 8:11622 (R:US)
Feasibility Studies
Policy and planning for the development of deep basin lignite on the Gulf Coast, 8:11726 (RA:US)
Field Tests
Depositional environments, subsurface stratigraphy, and post-burn characterization of the Paleocene-Eocene Hanna formation at the Hanna, Wyo UCG site: Hanna III experiment (Hanna III post mortem), 8:11623 (R:US)
Large-block experiments in underground coal gasification, 8:11664 (RA:US)
Overburden characterization and post-burn study of the Hoe Creek, Wyoming underground coal gasification site and comparison with the Hanna, Wyoming site, 8:11622 (R:US)
Policy and planning for the development of deep basin lignite on the Gulf Coast, 8:11726 (RA:US)
Overburden
Overburden characterization and post-burn study of the Hoe Creek, Wyoming underground coal gasification site and comparison with the Hanna, Wyoming site, 8:11622 (R:US)

INSOLATION
Data Analysis
Analyses of meteorological and insolation data useful for solar energy system design, 8:12008 (RA:CH)
Data Compilation
January 1980 environmental data for sites in the National Solar Data Network, 8:12013 (R:US)
Monitoring
Measurement and modelling of solar radiance, 8:12003 (RA:CH)
Research Programs
Swedish meteorologial programme related to solar and wind energy, 8:12009 (RA:CH)
Statistics
Climatic parameters for wind and solar power engineering, 8:12011 (RA:CH)
Principles of a probabilistic/statistical approach to the estimation of potential wind energy and solar radiation, 8:12000 (RA:CH)
Variations
Global and diffuse solar radiation dependent on cloud amount and turbidity, 8:12005 (RA:CH)

INSTRUMENTS (MEASURING)
See MEASURING INSTRUMENTS

INSULATING LIMITERS
See LIMITERS

INSULATION (THERMAL)
See THERMAL INSULATION

INSURANCE
Particular aspects and limits of absolute nuclear liability, 8:12401 (R:ES:In French)

INTEGRAL EQUATIONS
See also FREDHOLM EQUATION
Asymptotic Solutions
Asymptotic formulas for elliptic integrals, 8:13417 (R:US)

INTEGRATED CIRCUITS
Fabrication
Wafer-scale laser lithography. I. Pyrolytic deposition of metal microstructures (For ultra-large scale integrated circuits), 8:12887 (R:US)

INTEGRATED ENERGY UTILITY SYSTEMS
See IEUS

INTEGRATED UTILITY SYSTEMS
See TOTAL ENERGY SYSTEMS

INTERACTING BOSON MODEL
Taking into account proton-neutron symmetry in the framework of interacting boson model, 8:13367 (RA:SU:In Russian)

INTERACTIONS
For elementary particles and radiations only; not for CONFIGURATION INTERACTION.
See also PARTICLE INTERACTIONS

Meetings
Proceedings of the 2. Working Meeting on Radiation Interaction. Selected papers - part 2, 8:12743 (R:DD)

INTERCALATES
See CLATHRATES

INTERCONNECTED POWER SYSTEMS
Photovoltaic Power Supplies
Impact of residential utility-interactive PV-power systems on the utility, 8:12111 (R:US)
Reliability
Ensuring power-system stability, 8:12286 (J:US)

INTERFACES (EQUIPMENT)
See EQUIPMENT INTERFACES

INTERMEDIATE IMAGE SPECTROMETER
See MAGNETIC LENS SPECTROMETERS

INTERMEDIATE MASS NUCLEI
For nuclei with mass 41-180.
See also ANTIMONY 122
BARIUM 133
BARIUM 139
BARIUM 142
BARIUM 146
BARIUM 148
BROMINE 82
CADMIUM 112
CADMIUM 117
COBALT 60
GALLIUM 67
INDIUM 110
INDIUM 117
IODINE 123
IODINE 125
IODINE 129
IRON 57
KRYPTON 83
MOLYBDENUM 92
NICKEL 58
RARE EARTH NUCLEI
STRONTIUM 82
STRONTIUM 90
TECHNETIUM 93
TECHNETIUM 95
TECHNETIUM 99
TELLURIUM 124
TITANIUM 44
TITANIUM 50
TUNGSTEN 180
ZIRCONIUM 90
Collective Excitations
Nonlinear response and collective motion in nuclei at large amplitudes in time-dependent Hartree-Fock approximation, 8:13365 (RA:SU:In Russian)
Resonance
RPA description of isoscalar resonances in nonmagic nuclei, 8:13327 (RA:SU:In Russian)

INTERMEDIATES (REACTION)
See REACTION INTERMEDIATES

INTERNAL COMBUSTION ENGINES
See also DIESEL ENGINES
SPARK IGNITION ENGINES
Combustion Kinetics
Application of numerical-simulation methodology to automotive combustion. Technical progress report, 8:12646 (R:US)
Efficiency
Potential synergisms resulting from the use of methanol in gasoline, 8:11969 (RA:US)
Fluid Flow
Application of numerical-simulation methodology to automotive combustion. Technical progress report, 8:12646 (R:US)
Performance
Analysis and comparison of automotive-propulsion systems, 8:12643 (R:US)

INTERNAL CONTAMINATION
See RADIONUCLIDE KINETICS

INTERNATIONAL ATOMIC ENERGY AGENCY
See IAEA

INTERNATIONAL TOKAMAK REACTOR
See INTOR TOKAMAK

INTERSTELLAR SPACE
Nuclear Reactions
Radioactive ions beams for studying astrophysical nuclear reactions, 8:12909 (R:US)

INTOR TOKAMAK
International Tokamak Reactor.
Reviews
FED-INTOR activity, 8:13480 (R:US)

INVERSE SCATTERING PROBLEM
Quantum Mechanics
Integrability, duality, monodromy, and the structure of Bethe's ansatz, 8:13405 (R:US)

INVESTMENT
Risk Assessment
Input-output and risk analysis for a regional energy-development bank. Final report, 8:12467 (R:US)

INVISCID FLOW
See IDEAL FLOW

IODINATED ALIPHATIC HYDROCARBONS
Fragmentation
Fragmentation mechanism and energetics of some alkyl halide ions, 8:12809 (J:US)
Threshold Energy
Fragmentation mechanism and energetics of some alkyl halide ions, 8:12809 (J:US)

IODINE
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

IODINE 123
Electron Capture Decay
Exchange and overlap corrections to probabilities of electron capture by iodine nuclei in atoms and ions, 8:13330 (RA:SU:In Russian)

IODINE 125
Electron Capture Decay
Exchange and overlap corrections to probabilities of electron capture by iodine nuclei in atoms and ions, 8:13330 (RA:SU:In Russian)
Radiopharmaceuticals
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)
Tissue Distribution
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)

IODINE 129
Activation Analysis
Interference control in low-level ^{130}I analysis, 8:12770 (J:CH)
Iodine-129 separation and determination by neutron activation analysis, 8:12771 (J:CH)
Separation Processes
Iodine-129 separation and determination by neutron activation analysis, 8:12771 (J:CH)

IODINE IODIDES
See IODINE

ION BEAMS
See also BERYLLIUM 7 BEAMS
Beam Production
Radioactive ions beams for studying astrophysical nuclear reactions, 8:12909 (R:US)

ION CYCLOTRON-RESONANCE HEATING
See ICR HEATING

ION EXCHANGE MATERIALS
Stability
Thermal stability of ion-exchange resins, 8:11912 (R:SE)

ION EXCHANGE MEMBRANES
See ION EXCHANGE MATERIALS
MEMBRANES

ION MICROPROBE ANALYSIS
Nuclear Reactions
Sandia nuclear microprobe, 8:12931 (R:US)
Rutherford Scattering
Sandia nuclear microprobe, 8:12931 (R:US)

ION SOURCES
See also ELECTRON BEAM ION SOURCES

Electron Cyclotron-Resonance
Application of the electron-cyclotron resonance source to Lamb-shift polarized ion sources, 8:13235 (R:US)
Electron-Ion Collisions
Collisional mechanisms in D^- beam sources for MFE experiments and reactors. Technical progress report, November 1, 1981-October 31, 1982, 8:13472 (R:US)
Laser-Produced Plasma
Study on laser plasma as a source of multicharged ions for cyclotrons in the light element range (Li,Be,C), 8:12922 (R:SU:In Russian)

ION-ATOM COLLISIONS
Coulomb Excitation
Theory of Coulomb excitation and ionization, 8:13236 (R:US)
Coulomb Ionization
Theory of Coulomb excitation and ionization, 8:13236 (R:US)
Meetings
Seventh international seminar on ion-atom collisions (ISIAC VII): summary, 8:13237 (R:US)

ION-DRAG ACCELERATORS
See ELECTRON-RING ACCELERATORS

IONIZATION CALORIMETERS
See SHOWER COUNTERS

IONIZATION CHAMBERS
Energy Resolution
Cryogenic ionization chamber for high-resolution fission cross-section measurements, 8:13001 (J:NL)
Four-Pi Counting
Activity determination by a 4π-γ well-type ionization chamber, 8:12967 (R:BR)

IONIZING RADIATIONS
See also COSMIC RADIATION
GAMMA RADIATION
X RADIATION
Carcinogenesis
Oncogenic action of ionizing radiation on rat skin. Comprehensive progress report, February 1, 1980-January 31, 1983, 8:13141 (R:US)
Dosimetry
Radiation hazards in mining: control, measurement, and medical aspects (Lead abstract), 8:13170 (B:US)

ION-MOLECULE COLLISIONS
Meetings
Seventh international seminar on ion-atom collisions (ISIAC VII): summary, 8:13237 (R:US)

IOWA
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Seismicity
Regional tectonics and seismicity of southwestern Iowa. Final report, 1978-1982, 8:13211 (R:US)
Tectonics
Regional tectonics and seismicity of southwestern Iowa. Final report, 1978-1982, 8:13211 (R:US)

IRIDIUM
Crystallography
LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R:US)
Sorptive Properties
LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R:US)
Surface Properties
LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R:US)

IRIDIUM ALLOYS
Grain Boundaries
Surface studies of iridium-alloy grain boundaries associated with weld cracking, 8:11949 (R:US)

IRIDIUM COMPLEXES
Crystal Structure
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)
Molecular Structure
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)
Synthesis
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)

IRON
Absorption Spectroscopy
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Bioassay
Applications of nuclear technologies for in-vivo elemental analysis, 8:13059 (R:US)
Catalytic Effects
Catalysts for alcohols from biomass (C_2-C_4 alcohols), 8:11970 (R:US)
Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Laser Spectroscopy
Laser-excited atomic-fluorescence spectrometery as a tool for chemical analysis, 8:12756 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Neutron Transport
Method for analysis of averages over transmission energy of resonance neutrons, 8:13376 (RA:SU:In Russian)
Passivation
Moessbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces, 8:12675 (R:US)
Sorptive Properties
H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R:US)

IRON 57
Moessbauer Effect
Moessbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces, 8:12675 (R:US)

IRON ALLOYS
See also ALLOY-RA-333
HAYNES 188 ALLOY
HAYNES STELLITE 6B
INCONEL 600
IRON BASE ALLOYS
Corrosion
Determination of the corrosion rate of Ni-Fe coatings by measuring polarization resistance, 8:12703 (TJ:US)
Relaxation Time
Direct spectrum-analysis method for obtaining the relaxation-time spectrum from relaxation-response data: amorphous metals ($Fe_{40}Ni_{40}P_{14}B_6$), 8:12684 (R:US)

IRON BASE ALLOYS
See also ALLOY-HK-40
STEELS
Moessbauer Effect
Moessbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces, 8:12675 (R:US)

IRON BORIDES
Chemical Preparation
Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982, 8:11645 (R:US)
IRON COMPLEXES
Complexometry
Kintic study of ferrous nitrosyl complexes, 8:12800 (J:US)
Dissociation
Kintic study of ferrous nitrosyl complexes, 8:12800 (J:US)
Electron Spin Resonance
An ESR study of olefin iron carbonyl radical anions, 8:12799 (J:US)
Infrared Spectra
Isotope effects in the infrared spectra of the metal carbonyl hydride/deuteride anions (H/D)M(CO)$_4$p (M = Fe, Ru, or Os), 8:12798 (J:US)
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
IRON COMPOUNDS
See also IRON BORIDES
IRON NITRATES
IRON OXIDES
IRON SULFATES
Chemical Preparation
Preparation, reactivity, and stability of mixed-metal bimetallic complexes containing the pentacyanoferrate(II) moiety, 8:12797 (J:US)
Chemical Reaction Kinetics
Preparation, reactivity, and stability of mixed-metal bimetallic complexes containing the pentacyanoferrate(II) moiety, 8:12797 (J:US)
Comparative Evaluations
Preparation, reactivity, and stability of mixed-metal bimetallic complexes containing the pentacyanoferrate(II) moiety, 8:12797 (J:US)
IRON GARNETS
See FERRITE GARNETS
IRON NITRATES
Chemical Preparation
Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982, 8:11645 (R:US)
Reduction
Metal-boride catalysts for indirect liquefaction. Quarterly technical progress report, September 1, 1982-November 30, 1982, 8:11645 (R:US)
IRON OXIDES
Reduction
Systems model of the iron oxide hot-gas clean-up process. Volume 1. Theoretical and experimental results. Final report, September 1979-December 1980, 8:11660 (R:US)
Regeneration
Systems model of the iron oxide hot-gas clean-up process. Volume 1. Theoretical and experimental results. Final report, September 1979-December 1980, 8:11660 (R:US)
Sorptive Properties
Studies on the regeneration of sulfided iron oxide sorbent with steam-air mixtures. Final technical report, 8:11626 (R:US)
Systems model of the iron oxide hot-gas clean-up process. Volume 1. Theoretical and experimental results. Final report, September 1979-December 1980, 8:11660 (R:US)
Sulfidation
Systems model of the iron oxide hot-gas clean-up process. Volume 1. Theoretical and experimental results. Final report, September 1979-December 1980, 8:11660 (R:US)
IRON SULFATES
Chemical Reaction Kinetics
Partial-equilibrium model based on the kinetics of dissolution and equilibrium in solution of the UO_3-FeS_2-$Fe_2(SO_4)_3$-H_2SO_4 system, 8:12823 (R:US)
IRON-NICKEL BATTERIES
Performance Testing
Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment, 8:12459 (R:US)
IRREVERSIBLE PROCESSES
Irreversible cooperative processes on lattices, 8:12790 (R:US)
ISING MODEL
One-Dimensional Calculations
Dynamic Monte Carlo simulation of the one-dimensional Potts model, 8:13403 (R:US)
ISOCHRONOUS CYCLOTRONS
See also ORNL ISOCHRONOUS CYCLOTRON
TRIUMF CYCLOTRON
Superconducting Magnets
Deuteron cyclotron complex on the base of superconducting sector magnets, 8:12895 (R:SU:In Russian)
ISOTOPE DILUTION
Isotope-dilution analyses of the metallic elements, 8:12752 (R:US)
ISOTOPE ENRICHMENT
See ISOTOPE SEPARATION
ISOTOPE SEPARATION
For separation of isotopes of the same element only.
See also LASER ISOTOPE SEPARATION
SEPARATION NOZZLE METHOD
Computer Codes
Multipass batch-step advanced isotope separation campaign models, 8:11845 (J:US)
ISOTOPE SEPARATION PLANTS
Safeguards
Results of research and development work 1981 of the Development Department for Nuclear Materials Safeguards, 8:11938 (R:DE:In German)
ISOTOPIC SEPARATION
See ISOTOPE SEPARATION
ISRAEL
Wind Power
Wind power potential in Israel and the eastern Mediterranean, 8:12257 (RA:CH)
ITALY
Meteorology
Annual meteorological report for 1979 for the EUREX site of Saluggia, 8:13050 (R:IT:IT)
ITERATIVE METHODS
See also FINITE DIFFERENCE METHOD
Numerical solution of large sparse linear systems, 8:13541 (R:FR:In French)
IUS
See TOTAL ENERGY SYSTEMS

J

J-3105 RESONANCES
See PSI-3105 RESONANCES
JAILS
See PUBLIC BUILDINGS
JAPAN
Energy Consumption
Fuel-cell technology assessment. Volume II. Evaluation of Japan, 8:12527 (R:US)
Power Generation
Fuel-cell technology assessment. Volume II. Evaluation of Japan, 8:12527 (R:US)
JET MODEL
Reviews
Jets: models versus experimental data, I, 8:13276 (R:US)
JINR SYNCHROTRON
Polarized Beams
Workshop on acceleration of polarized protons: summary report, 8:12899 (R:US)

K

K-25 PLANT
See ORGDP
KAHL-VAK REACTOR
See VAK REACTOR
KALKAR POWER REACTOR
See SNR-1 REACTOR
KANSAS
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Temperature Logging
Assessment of the geothermal resources of Kansas. Volume II. Appendices. Final report, 8:12215 (R:US)
KAOLINITE
Sorptive Properties
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
KARLSRUHE NUCLEAR RESEARCH CENTER
See KERNFORSCHUNGSZENTRUM KARLSRUHE
KBW GASIFICATION PROCESS
Commercialization
KBW: improvements on a well-known process, 8:11586 (RA:US)
Flowsheets
KBW: improvements on a well-known process, 8:11586 (RA:US)
KEK SYNCHROTRON
Japan National Lab for High Energy Physics Synchrotron.
Polarized Beams
Workshop on acceleration of polarized protons: summary report, 8:12899 (R:US)
KELLOGG PROCESS
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)
KENTUCKY
Black Shales
Appraisal of landsat lineaments as faults in western Kentucky. Final report, 8:11816 (R:US)
Coal Deposits
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Geophysical Surveys
Appraisal of landsat lineaments as faults in western Kentucky. Final report, 8:11816 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Natural Gas Deposits
Appraisal of landsat lineaments as faults in western Kentucky. Final report, 8:11816 (R:US)
Radioactive Waste Facilities
Low-level radioactive waste disposal: commercial facilities no longer operating, 8:11871 (RA:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
KERNFORSCHUNGSZENTRUM KARLSRUHE
Radiation Monitoring
Monitoring for environmental radioactivity at the Karlsruhe Nuclear Research Center in 1980, 8:13041 (R:DE:In German)
Research Programs
Results of research and development work 1981 of the Institute for Neutron Physics and Reactor Engineering, 8:12287 (R:DE:In German)
KERNKRAFTWERK BIBLIS
See BIBLIS-A REACTOR
KERNKRAFTWERK LINGEN
See LINGEN REACTOR
KERNKRAFTWERK OBRIGHEIM
See OBRIGHEIM REACTOR
KERNKRAFTWERK RWE-BAYERNWERK
See RWE-BAYERNWERK REACTOR
KERNKRAFTWERK STADE
See STADE REACTOR
KERNKRAFTWERK WUERGASSEN
See WUERGASSEN REACTOR
KETOPROPIONIC ACID-ALPHA
See PYRUVIC ACID
KEVLAR
See ARAMIDS
KILNS
Refuse Derived Fuels
Urban waste as a potential energy source for brick plants, 8:12632 (R:US)
KIMBERLITES
Petrogenesis
Origin of a sanidine-coesite grospydite, 8:13218 (R:US)
Phase Studies
Origin of a sanidine-coesite grospydite, 8:13218 (R:US)
KINETICS EQUATIONS (REACTOR)
See REACTOR KINETICS EQUATIONS
KKS REACTOR
See STADE REACTOR
KNK REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)
KNOCK-ON ELECTRONS
See ELECTRONS
KOMPAKTE NATRIUMGEKUEHLTE REAKTOR
See KNK REACTOR
KOREA (SOUTH)
See REPUBLIC OF KOREA
KRB REACTOR
See RWE-BAYERNWERK REACTOR
KRYPTON 85
Radionuclide Migration
Validation of the atmospheric transport model: comparison of observed krypton-85 concentrations with those computed using a Gaussian plume model, 8:13048 (J:US)
Uses
Radioisotope-powered light sources, 8:11946 (R:US)
KUOSHENG-1 REACTOR
Pipes
Safety analysis of Kuosheng Mark III SRV piping response to discharge loading, 8:12289 (R:US)
Relief Valves
Safety analysis of Kuosheng Mark III SRV piping response to discharge loading, 8:12289 (R:US)
KUOSHENG-2 REACTOR
Pipes
Safety analysis of Kuosheng Mark III SRV piping response to discharge loading, 8:12289 (R:US)
Relief Valves
Safety analysis of Kuosheng Mark III SRV piping response to discharge loading, 8:12289 (R:US)
KWL REACTOR
See LINGEN REACTOR
KWO REACTOR
See OBRIGHEIM REACTOR

L

LABELLED COMPOUNDS
Compounds labelled with either stable or radioactive isotopes.
See also RADIOPHARMACEUTICALS
TRITIUM COMPOUNDS
Chemical Preparation
New method using anhydrous [^{18}F]fluoride to radiolabel 2-[^{18}F]fluoro-2-deoxy-D-glucose, 8:12826 (J:US)
Tissue Distribution
New method using anhydrous [^{18}F]fluoride to radiolabel 2-[^{18}F]fluoro-2-deoxy-D-glucose, 8:12826 (J:US)

LACTOFERRIN
Biological Effects
Regulation of the colony-stimulating activity produced by a murine marrow-derived cell line (H-1), 8:13120 (J:US)
LAGRANGIAN
See LAGRANGIAN FUNCTION
LAGRANGIAN FUNCTION
Mesh Generation
Development of a multimaterial, two-dimensional, arbitrary Lagrangian-Eulerian mesh computer program, 8:13569 (R:US)
LAMPF LINAC
Impedance
Inductive-wall and longitudinal space-charge impedances in LAMPF II, 8:12905 (R:US)
Radioactive Wastes
Waste management at LAMPF, 8:11914 (J:US)
LAND FILLS
See SANITARY LANDFILLS
LANDFILLS
See SANITARY LANDFILLS
LANGMUIR OSCILLATIONS
See PLASMA WAVES
LANGUAGES (PROGRAMMING)
See PROGRAMMING LANGUAGES
LANTHANIDES
See RARE EARTHS
LANTHANUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
LANTHANUM 140
Energy Levels
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
LANTHANUM 142
Energy Levels
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
LANTHANUM 146
Energy Levels
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
LANTHANUM 148
Energy Levels
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
LANTHANUM ALLOYS
Chemical Preparation
Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga), 8:12697 (J:US)
Hydridation
Modification of hydriding properties of $LaCo_5$ by partial substitutions/sub 5-x/M/sub x/ with M = Al,Ga), 8:12697 (J:US)
LASER BEAM MACHINING
Optics
Laser-beam-alignment system (Patent), 8:12866 (P:US)
LASER IMPLOSIONS
Compression measurement in laser driven implosion experiments, 8:13528 (BA:US)
Symmetry
Stability and symmetry in inertial-confinement fusion, 8:13487 (R:US)
LASER ISOTOPE SEPARATION
Research Programs
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
LASER MIRRORS
Fabrication
Laser-interferometer position-feedback for precision machine tools, 8:13499 (R:US)
LASER SPECTROSCOPY
Accelerator Facilities
Sizes and shapes of short-lived nuclei via laser spectroscopy. Progress report, January 31, 1981-July 31, 1982, 8:12916 (R:US)
Dye Lasers
Laser-excited atomic-fluorescence spectrometery as a tool for chemical analysis, 8:12756 (R:US)
Meetings
Laser techniques for extreme ultraviolet spectroscopy, 8:13245 (B:US)
LASER TARGETS
Acceleration
Studies of laser-plasma interactions, emphasizing ablative acceleration of thin foils, 8:13524 (BA:US)
Energy Transfer
Heat transport with cold and hot electrons allowing for flux limitation by Shvarts' method, 8:13467 (R:CA)
Fabrication
1981 inertial fusion research annual technical report, 8:13471 (R:US)
Recent laser fusion experiments at KMS, 8:11944 (R:US)
Laser Implosions
Compression measurement in laser driven implosion experiments, 8:13528 (BA:US)
Stability and symmetry in inertial-confinement fusion, 8:13487 (R:US)
LASER-PRODUCED PLASMA
Brillouin Effect
Nonlinear rehavior of stimulated scatter in large underdense plasmas, 8:13526 (BA:US)
Numerical study of phase conjugation in stimulated Brillouin scattering from an optical waveguide, 8:13488 (R:US)
Distribution Functions
Heat transport with cold and hot electrons allowing for flux limitation by Shvarts' method, 8:13467 (R:CA)
Electron Transfer
Electron transport effects in laser produced plasmas, 8:13525 (BA:US)
Energy Transfer
Heat transport with cold and hot electrons allowing for flux limitation by Shvarts' method, 8:13467 (R:CA)
Nonlinear Problems
Nonlinear rehavior of stimulated scatter in large underdense plasmas, 8:13526 (BA:US)
LASERS
Light Amplification by Stimulated Emission of Radiation.
See also FREE ELECTRON LASERS
GAS LASERS
X-RAY LASERS
Seven technologies for the eighties, 8:12470 (R:US)
Beam Pulsers
Can optical phase conjugators produce a very short conjugate pulse, 8:12867 (BA:US)
Plasma Diagnostics
Laser applications, 8:13432 (RA:DE:In German)
LASL
Buildings
Los Alamos National Laboratory building cost index, 8:12850 (R:US)
Emergency Plans
Capabilities of the Los Alamos National Laboratory's environmental emergency-response vehicle, 8:13042 (R:US)
Quality Assurance
Quality assurance for environmental analytical chemistry at Los Alamos, 8:13028 (R:US)
Radiation Monitoring
Capabilities of the Los Alamos National Laboratory's environmental emergency-response vehicle, 8:13042 (R:US)
LATENT HEAT STORAGE
Phase Change Materials
Fundamental heat-transfer processes related to phase-change thermal-storage media, 8:12452 (R:US)

LATTICE FIELD THEORY
Why QCD lattice theory is important to spin physicists, 8:13285 (R:US)
Reviews
Lattice gauge theories, 8:13283 (R:US)
LATTICES (CRYSTAL)
See CRYSTAL LATTICES
LATTICES (REACTOR)
See REACTOR LATTICES
LAUNDRIES
Solar Heating Systems
Demonstrate use of solar energy for laundromat washing and drying. Final report, 8:12171 (R:US)
LAWRENCE LIVERMORE LABORATORY
Computer Networks
LINCS: Livermore's network architecture (Octopus computing network), 8:13568 (R:US)
Pollution Control
On-line liquid-effluent monitoring of sewage at Lawrence Livermore National Laboratory, 8:13092 (R:US)
LC-FINING
Process Development Units
Integrated two-stage liquefaction. Topical technical progress report completion of Indiana V program, April 1, 1981-September 30, 1981, 8:11618 (R:US)
LEACHATES
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Chemical Analysis
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Chemical Composition
Demonstration of landfill gas-enhancement techniques in landfill simulators, 8:11959 (R:US)
Geochemistry of leachates from selected coal mining and combustion wastes. Project completion report, July 1977-September 1979, 8:11692 (R:US)
Electric Conductivity
Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance, 8:11867 (R:US)
LEACHING
Chemical Reaction Kinetics
Release kinetics and alteration of waste glass in crystalline rock systems, 8:11915 (J:NL)
LEAD
Activation Analysis
Activation of Tl, Pb and Bi by 10-160 MeV neutrons: possible application to the analysis of Bi, 8:12769 (J:CH)
Bioassay
Applications of nuclear technologies for in-vivo elemental analysis, 8:13059 (R:US)
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Gas Chromatography
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
LEAD 205
Energy Levels
Effective interaction and structure of odd spherical nuclei, 8:13346 (RA:SU:In Russian)
LEAD 208
Multipole Transitions
Effect the residual force spin components on the properties of the electrical type states in the spherical nuclei, 8:13326 (RA:SU:In Russian)
LEAD 208 TARGET
Carbon 12 Reactions
Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R:US)
Nitrogen 14 Reactions
Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R:US)
Nitrogen 15 Reactions
Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R:US)
Oxygen 16 Reactions
Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R:US)
LEAD 210
Radioecological Concentration
Models of the distribution of ^{210}Pb in a section across the North Equatorial Atlantic Ocean, 8:13093 (J:US)
LEAD 211
Energy Levels
Effective interaction and structure of odd spherical nuclei, 8:13346 (RA:SU:In Russian)
LEAD ALLOYS
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
LEAD COMPOUNDS
Electrical Properties
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
Grain Orientation
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
LEAD-ACID BATTERIES
Performance Testing
Testing of the Eagle-Picher nickel-iron, the Globe ISOA lead-acid, and the Westinghouse nickel-iron battery subsystems in an electric-vehicle environment, 8:12459 (R:US)
LEAST SQUARE FIT
Numerical solution of large sparse linear systems, 8:13541 (R:FR:In French)
Computer Codes
COMFIT. A computer program for determining best fitting curves, 8:13548 (R:NL)
LEAVES
Activation Analysis
Procedures for multielement analysis using high-flux fast-neutron activation, 8:12767 (J:CH)
LEPTON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
LEUKEMIA
Epidemiology
Selected epidemiological observations of cell-specific leukemia mortality in the USA, 1969-1977, 8:13138 (R:US)
LEVULOSE
See FRUCTOSE
LIABILITIES
Insurance
Particular aspects and limits of absolute nuclear liability, 8:12401 (R:ES:In French)
LI-DRIFTED SI DETECTORS
Crystal Growth
Characterization of large diameter silicon by low-bias charge collection analysis in Si(Li) pin diodes, 8:12997 (J:NL)
LIGASES
Code number 6.
Enzyme Activity
Ligase-deficient yeast cells exhibit defective DNA rejoining and enhanced gamma ray sensitivity, 8:13160 (J:US)
LIGHT
See VISIBLE RADIATION
LIGHT NUCLEI
For nuclei with mass 1-40.
See also ALUMINIUM 24
BERYLLIUM 6
BERYLLIUM 7

CALCIUM 40
DEUTERIUM
FLUORINE 18
HELIUM 6
LITHIUM 6
LITHIUM 7
MAGNESIUM 24
NITROGEN 13
NITROGEN 14
OXYGEN 15
OXYGEN 16
PHOSPHORUS 32
SILICON 28
SODIUM 24
SULFUR 35
TRITIUM

Coulomb Energy
Coulomb and total energies of light nuclei, 8:13368 (RA:SU:In Russian)
Energy-Level Density
Evaluation of the sd-nucleus level density in the framework of exactly solved model with strongly limited dynamics, 8:13363 (RA:SU:In Russian)
Isobaric Nuclei
Evaluation of the sd-nucleus level density in the framework of exactly solved model with strongly limited dynamics, 8:13363 (RA:SU:In Russian)
Nuclear Forces
Parity-nonconserving nuclear forces, 8:13355 (R:US)

LIGHT SOURCES
Phosphors
Radioisotope-powered light sources, 8:11946 (R:US)
Radiation Sources
Radioisotope-powered light sources, 8:11946 (R:US)

LIGHT WATER COOLED REACTORS
See WATER COOLED REACTORS

LIGNIN
Electrochemistry
Survey of the electrochemistry of some biomass-derived compounds, 8:12097 (R:US)

LIGNITE
Chemical Composition
Analysis of sulfur retention in fluidized-bed combustion, 8:11770 (RA:US)
Design for lignite firing at the San Miguel Power Plant, 8:12272 (RA:US)
Fluidized-bed combustion studies of Texas lignite, 8:11769 (RA:US)
Combustion
Recent research on ash fouling in combustion of low-rank coals, 8:12275 (RA:US)
Constraints
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Feasibility Studies
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Fluidized-Bed Combustion
Analysis of sulfur retention in fluidized-bed combustion, 8:11770 (RA:US)
Technical and economic aspects of a lignite-fired AFBC boiler, 8:11768 (RA:US)
Freezing
Operating experience in burning lignite at Coal Creek Station, 8:11756 (RA:US)
Materials Handling
Operating experience in burning lignite at Coal Creek Station, 8:11756 (RA:US)
Meetings
Technology and use of lignite, 8:11718 (R:US)
Production
Lignite in Europe: use, present and future production (1980; by country), 8:11735 (RA:US)
Past, present, and projected energy sources for electrical generation in Texas (Texas; 1970 to 1984), 8:11736 (RA:US)
Research Programs
Technology and use of lignite, 8:11718 (R:US)
Texas Energy Development Fund. Project status reports, 8:11998 (R:US)

LIMITERS
Erosion
Graphite limiter and armor damage in Doublet III, 8:13476 (R:US)
Sputtering
Graphite limiter and armor damage in Doublet III, 8:13476 (R:US)

LINACS
See LINEAR ACCELERATORS

LINEAR ACCELERATORS
See also CERN LINAC
FMIT LINAC
LAMPF LINAC
QUADRUPOLE LINACS
STANFORD 20-GEV LINAC
Linac technology for free-electron lasers, 8:12865 (R:US)
Colliding Beams
Physics with linear colliders in the TeV CM energy region, 8:12897 (R:US)
Electric Fields
High energy e^+-e^- collider using an inverse free electron laser accelerator, 8:12894 (R:US)
Experiment Planning
Physics with linear colliders in the TeV CM energy region, 8:12897 (R:US)
Hydrogen 1 Minus Beams
High-brightness negative-hydrogen linear accelerator, 8:12906 (R:US)
Performance
High-brightness negative-hydrogen linear accelerator, 8:12906 (R:US)
Radioactive Effluents
Measurements and modeling of gamma absorbed doses due to releases from a linear proton accelerator: experimental design and preliminary results, 8:13043 (R:US)

LINEAR PROGRAMMING
Algorithms
Advanced implementation of the Dantzig-Wolfe decomposition algorithm for linear programming, 8:13570 (J:NL)

LINGEN REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)

LIPOPROTEINS
Agglomeration
Aggregation of low density lipoproteins with unilamellar phosphatidylcholine vesicles, 8:13109 (J:US)

LIQUEFIED NATURAL GAS
Air Pollution Control
Prevention and control of LNG tanker spills with membrane barrier systems inside cargo tanks. Final technical report, October 1981-November 1982, 8:13027 (R:US)
Flaring
Flare system for safe disposal of LNG from a disabled tanker, 8:13080 (R:US)
Gas Spills
Prevention and control of LNG tanker spills with membrane barrier systems inside cargo tanks. Final technical report, October 1981-November 1982, 8:13027 (R:US)
Pipelines
Tests of cryogenic pigs for use in liquefied gas pipelines, 8:11821 (R:US)

LIQUEFIED PETROLEUM GASES
Pipelines
Tests of cryogenic pigs for use in liquefied gas pipelines, 8:11821 (R:US)
Production
Oil refining flexibility and alternative fuels (Brazil), 8:11807 (RA:BR)

LIQUID COLUMN CHROMATOGRAPHY
Equipment
Multicomponent separations using a continuous annular chromatograph, 8:12759 (R:US)

LIQUID CRYSTALS
Phase Transformations
High-resolution x-ray scattering, 8:12913 (R:US)
X-Ray Diffraction
High-resolution x-ray scattering, 8:12913 (R:US)

Synchrotron X-ray diffraction from liquid crystals, perfect crystals and perfect liquid crystals, 8:13375 (RA:DK:In Danish)

LIQUID EFFLUENTS
See LIQUID WASTES

LIQUID METAL TEST FACILITIES
See TEST FACILITIES

LIQUID METAL-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS

LIQUID WASTES
See also WASTE WATER
Flow Rate
Investigation of the effect of the uranyl ion on proton-spin-relaxation times in aqueous solutions, 8:13007 (R:US)

LITEK LAMP
See FLUORESCENT LAMPS

LITHIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Permeability
Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium, 8:13495 (R:US)
Solvent Extraction
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
Sorptive Properties
Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium, 8:13495 (R:US)

LITHIUM 6
Ground States
Detailed investigation of ground state structure of ^{6}Li-^{6}He-^{6}Be nuclei, 8:13307 (RA:SU:In Russian)
Nuclear Magnetic Resonance
NMR in doped monocrystals of superionic conductor β-$LiAlSiO_4$ (β-eukryptite), 8:12698 (J:CH:In German)

LITHIUM 6 TARGET
Electron Reactions
Polarization phenomena in the $e^- + {}^{6}Li \rightarrow e^- + {}^{6}Li^{*}$ process, 8:13308 (RA:SU:In Russian)

LITHIUM 7
Nuclear Magnetic Resonance
NMR in doped monocrystals of superionic conductor β-$LiAlSiO_4$ (β-eukryptite), 8:12698 (J:CH:In German)

LITHIUM 7 REACTIONS
Fusion Reactions
Nuclear physics research. Progress report, April 1, 1982-March 31, 1983, 8:13302 (R:US)

LITHIUM 7 TARGET
Electron Reactions
Electromagnetic and weak scattering of electrons by the 1p shell nuclei and space parity violation, 8:13311 (RA:SU:In Russian)
Proton Reactions
Algebraic realization of the resonating-group method for multichannel scattering problem in eight nucleons system, 8:13306 (RA:SU:In Russian)

LITHIUM ALLOYS
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)

LITHIUM COMPOUNDS
See also LITHIUM OXIDES
Structural Chemical Analysis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
Synthesis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)

LITHIUM FLUORIDES
Thermoluminescence
Recent investigations of the thermoluminescence mechanisme in lithium fluoride, 8:12950 (RA:DE:In German)

LITHIUM IONS
Ion Sources
Study on laser plasma as a source of multicharged ions for cyclotrons in the light element range (Li,Be,C), 8:12922 (R:SU:In Russian)

LITHIUM OXIDES
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
Ionic Conductivity
NMR in doped monocrystals of superionic conductor β-$LiAlSiO_4$ (β-eukryptite), 8:12698 (J:CH:In German)

LITHIUM-CHLORINE BATTERIES
Electrodes
Ambient temperature rechargeable lithium battery. Final report 1 Mar 81-28 Feb 82, 8:12456 (R:US)
Performance
Ambient temperature rechargeable lithium battery. Final report 1 Mar 81-28 Feb 82, 8:12456 (R:US)

LITHIUM-COPPER CHLORIDE BATTERIES
Electrodes
Ambient temperature rechargeable lithium battery. Final report 1 Mar 81-28 Feb 82, 8:12456 (R:US)
Performance
Ambient temperature rechargeable lithium battery. Final report 1 Mar 81-28 Feb 82, 8:12456 (R:US)

LITHIUM-SULFUR BATTERIES
Hazards
Lithium-sulfur dioxide (Li/SO_2) battery safety hazards - thermal studies. Final report 24 Dec 80-5 Mar 82, 8:12457 (R:US)
Safety
Investigation of lithium sulfur dioxide (Li/SO2) battery safety hazards -- chemical studies. Final report 24 Dec 80-23 dec 81, 8:12454 (R:US)

LITHIUM-WATER-AIR BATTERIES
Electrodes
Ambient temperature rechargeable lithium battery. Final report 1 Mar 81-28 Feb 82, 8:12456 (R:US)
Performance
Ambient temperature rechargeable lithium battery. Final report 1 Mar 81-28 Feb 82, 8:12456 (R:US)

LIVER
Activation Analysis
Procedures for multielement analysis using high-flux fast-neutron activation, 8:12767 (J:CH)
Radionuclide Kinetics
1976 Hanford americium exposure incident: in vivo measurements, 8:13147 (R:US)

LIXIVIATION
See LEACHING

LMFBR TYPE REACTORS
See also CLINCH RIVER BREEDER REACTOR
EBR-2 REACTOR
PHENIX REACTOR
SNR-1 REACTOR
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R:US)
Fuel Assemblies
User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis, 8:12314 (R:US)
User's guide to HEATRAN: a computer program for three-dimensional transient fluid-flow and heat-transfer analysis, 8:12315 (R:US)
Fuel Cycle
Nuclear-fuel-cycle costs. Consolidated Fuel-Reprocessing Program, 8:11847 (R:US)
Fuel Element Clusters
Measurements of peripherical static pressure and pressure drop in a rod bundle with helical wire wrap spacers, 8:12316 (R:BR:In Portuguese)

Semi-empirical model for the calculation of flow friction factors in wire-wrapped rod bundles, 8:12317 (R:BR:In Portuguese)
Fuel Elements
State of art of the methods for thermohydraulics design of LMFBR fuel elements, 8:12318 (R:BR:In Portuguese)
Heterogeneous Effects
In-pile fuel cycle of heterogeneous oxide fast reactors, 8:12321 (TG:GB)
On-Line Measurement Systems
Fast breeder reactor on-line monitoring and diagnosis strategy development via Dynamic Data System (DDS) methodology, 8:12364 (D:US)
Radioactive Materials
Breeder reactor program T-3 cask, 8:12445 (J:US)
Reactor Core Disruption
Heat, mass, and momentum transfer from large two-phase bubbles (UVABUBL), 8:12320 (D:US)
Reactor Materials
Determination of carbon in sodium by the distillation-combustion method, 8:12319 (R:IN)
Spent Fuel Casks
Breeder reactor program T-3 cask, 8:12445 (J:US)
T-3 cask handling systems at HFEF, 8:12446 (J:US)
Thorium Cycle
Possible types of breeders with thorium cycle, 8:12312 (R:BR:In Portuguese)

LNG
See LIQUEFIED NATURAL GAS

LNG SPILLS
See GAS SPILLS

LOFT REACTOR
Calculations for LOFT experiment L3-1 with the homogeneous version of the computer code DRUFAN, 8:12396 (R:DE:GE)

LONG COUNTERS
Response Functions
Energy dependence of the response of a ^{3}He long counter, 8:12998 (J:NL)

LONG VALLEY
Aerial Surveying
Airborne-temperature-survey maps of heat-flow anomalies for exploration geology, 8:12202 (R:US)
Heat Flow
Airborne-temperature-survey maps of heat-flow anomalies for exploration geology, 8:12202 (R:US)
Temperature Surveys
Airborne-temperature-survey maps of heat-flow anomalies for exploration geology, 8:12202 (R:US)

LONGITUDINAL PINCH
See also BELT PINCH
Electron-Ion Collisions
ZAPP: Z-pinch atomic physics program, 8:13452 (R:US)
Plasma Diagnostics
ZAPP: Z-pinch atomic physics program, 8:13452 (R:US)

LONG-LENS SPECTROMETERS
See MAGNETIC LENS SPECTROMETERS

LONGWALL MINING
Conveyors
Longwall data bank. Quarterly project status report, August 28-November 28, 1982 and semiannual report No. 3, 8:11731 (R:US)
Information Systems
Longwall data bank. Quarterly project status report, August 28-November 28, 1982 and semiannual report No. 3, 8:11731 (R:US)
Powered Supports
Longwall data bank. Quarterly project status report, August 28-November 28, 1982 and semiannual report No. 3, 8:11731 (R:US)
Productivity
Longwall data bank. Quarterly project status report, August 28-November 28, 1982 and semiannual report No. 3, 8:11731 (R:US)
Shearer Loaders
Longwall data bank. Quarterly project status report, August 28-November 28, 1982 and semiannual report No. 3, 8:11731 (R:US)

LOS ALAMOS MESON PHYSICS FACILITY
See LAMPF LINAC

LOS ALAMOS SCIENTIFIC LABORATORY
See LASL

LOSS OF COOLANT
Flow Models
UW-4F: a mechanistic four-fluid two-phase flow model for LOCA analysis during reflood, 8:12442 (D:US)
Heat Transfer
Calculations for LOFT experiment L3-1 with the homogeneous version of the computer code DRUFAN (PWR), 8:12396 (R:DE:GE)
First comparison of the results of standard problems carried out in the blowdown region (PWR), 8:12397 (R:DE:GE)
LOCA hydroloads calculations with multidimensional nonlinear fluid/structure interaction. Volume 3. Fluid/structure interaction studies using 3-D STEALTH/WHAMSE. Final report (PWR), 8:12390 (R:US)
LOCA simulation in NRU program. Data report for thermal-hydraulic experiment 2 (TH-2) (PWR; BWR), 8:12411 (R:US)
Physical phenomena of a small-break loss-of-coolant accident in a PWR, 8:12423 (J:US)
Recent advances in evaluation of BWR loss-of-coolant accident, 8:12424 (J:US)
Hydraulics
Calculations for LOFT experiment L3-1 with the homogeneous version of the computer code DRUFAN (PWR), 8:12396 (R:DE:GE)
First comparison of the results of standard problems carried out in the blowdown region (PWR), 8:12397 (R:DE:GE)
Fluid-structure-coupling algorithm (BWR), 8:12420 (R:US)
LOCA hydroloads calculations with multidimensional nonlinear fluid/structure interaction. Volume 3. Fluid/structure interaction studies using 3-D STEALTH/WHAMSE. Final report (PWR), 8:12390 (R:US)
LOCA simulation in NRU program. Data report for thermal-hydraulic experiment 2 (TH-2) (PWR; BWR), 8:12411 (R:US)
Physical phenomena of a small-break loss-of-coolant accident in a PWR, 8:12423 (J:US)
Recent advances in evaluation of BWR loss-of-coolant accident, 8:12424 (J:US)
Hydrodynamics
Fluid-structure-coupling algorithm (BWR), 8:12420 (R:US)
Pressure Gradients
CONTEMPT 4/MOD 3: a multicompartment containment system analysis program (PWR), 8:12412 (R:US)
Temperature Gradients
CONTEMPT 4/MOD 3: a multicompartment containment system analysis program (PWR), 8:12412 (R:US)
Test Facilities
LOCA simulation in NRU program. Data report for thermal-hydraulic experiment 2 (TH-2) (PWR; BWR), 8:12411 (R:US)

LOSS OF FLUID TEST REACTOR
See LOFT REACTOR

LOUISIANA
Coal Deposits
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Energy Demand
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Geologic Structures
Analysis of three geopressured geothermal aquifer-natural gas fields; Duson Hollywood and Church Point, Louisiana, 8:12186 (R:US)

Geopressured Systems
Analysis of three geopressured geothermal aquifer-natural gas fields; Duson Hollywood and Church Point, Louisiana, 8:12186 (R:US)
Screening of three proposed DOE geopressured-geothermal aquifer natural gas project areas for potential conflicting commercial production: Freshwater Bayou, Lake Theriot, and Kaplan, Louisiana, 8:12200 (R:US)
Industrial Plants
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Louisiana peat resources assessment, 8:11706 (RA:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)

LOW INCOME GROUPS
Training
Training farmworkers for industrial jobs: a longitudinal study, 8:12466 (R:US)

LOW LEVEL COUNTERS
Performance Testing
Mini-instruments environmental monitor Type 5.10G. Instrument evaluation no. 21, 8:12975 (R:GB)

LOW TEMPERATURE
Biological Effects
Control of proton efflux from corn root tissue by an injury-sensing mechanism, 8:13121 (J:NL)

LOW-HEAD HYDROELECTRIC POWER PLANTS
Prior to August 1978 HYDROELECTRIC POWER PLANTS was used.
Capitalized Cost
Goodyear Lake hydroelectric generating station redevelopment. Final operating cost report, 8:11997 (R:US)
Economic Analysis
Report of investigation for hydroelectric generation. Final report, 8:11996 (R:US)
Feasibility Studies
Report of investigation for hydroelectric generation. Final report, 8:11996 (R:US)
Operating Cost
Goodyear Lake hydroelectric generating station redevelopment. Final operating cost report, 8:11997 (R:US)

LOW-LEVEL RADIOACTIVE WASTES
Classification
Waste classification system for low-level radioactive wastes, 8:11882 (R:US)
Government Policies
Planning state policy on low-level radioactive waste, 8:11869 (RA:US)
Transport
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)

LP-GAS
See LIQUEFIED PETROLEUM GASES

LUCIE-1 REACTOR
Secondary Coolant Circuits
Secondary water chemistry control at St. Lucie No. 1, 8:12307 (R:US)
Water Chemistry
Secondary water chemistry control at St. Lucie No. 1, 8:12307 (R:US)

LUNG CLEARANCE
Dynamic Function Studies
Pulmonary alveolar pores and alveolar macrophage-mediated particle clearance, 8:13137 (J:US)

LUNGS
Biological Radiation Effects
Dose to basal cells in bronchial epithelium from long-lived alpha emitters in uranium mines, 8:13171 (BA:US)
Radiation hazards in mining: control, measurement, and medical aspects (Lead abstract), 8:13170 (B:US)
Dynamic Function Studies
Pulmonary function and /sup 81m/Kr scans in obstructive pulmonary disease, 8:13133 (J:GB)
Microstructure
Pulmonary alveolar pores and alveolar macrophage-mediated particle clearance, 8:13137 (J:US)
Radiation Doses
Estimation of the cumulative exposure to uranium mine atmospheres by in vivo measurements of lead-210 in the skull, 8:13401 (BA:US)
Radionuclide Kinetics
1976 Hanford americium exposure incident: in vivo measurements, 8:13147 (R:US)
Distribution of inhaled $^{239}PuO_2$ in rat and hamster lung, 8:13165 (J:GB)
Measurements to determine the solubility of uranium yellowcake materials in the lungs of millworkers following acute exposure, 8:13156 (R:US)
Scintiscanning
Pulmonary function and /sup 81m/Kr scans in obstructive pulmonary disease, 8:13133 (J:GB)

LUTETIUM
Electronic Structure
Electronic structure of hcp lutetium, 8:12678 (R:US)
Magnetic Properties
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)
Magnetic Susceptibility
Magnetic susceptibility of scandium-hydrogen and lutetium-hydrogen solid-solution alloys from 2 to 300°K, 8:12681 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Superconductivity
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)

LUTETIUM HYDRIDES
Magnetic Susceptibility
Magnetic susceptibility of scandium-hydrogen and lutetium-hydrogen solid-solution alloys from 2 to 300°K, 8:12681 (R:US)

LUTETIUM ISOTOPES
Decay
Calculations of half-life of deformed and spherical nuclei, 8:13341 (RA:SU:In Russian)

LYMPHOCYTES
Immune Reactions
Marrow-tumor interactions: the role of the bone marrow in controlling chemically induced tumors. Annual progress report, August 1, 1981-July 31, 1982, 8:13118 (R:US)

LYMPHOID CELLS
See LYMPHOCYTES

M

MA 754
See NICKEL BASE ALLOYS

MA 956
See IRON BASE ALLOYS

MACERALS
Chemical Reaction Kinetics
Canadian low-rank coals: resources, conversion and utilization, 8:11722 (RA:US)

MACHINE PARTS
Measuring Instruments
Evaluation of coordinate measuring machines, 8:13005 (R:US)

MACHINE TOOLS
See also GRINDING MACHINES
MILLING MACHINES
Control Systems
Control-systems improvements in a precision coordinate measuring machine, 8:12857 (R:US)

MACROPHAGES
Biochemistry
Degradation of connective tissue matrices by macrophages. III. Morphological and biochemical studies on extracellular, pericellular, and intracellular events in matrix proteolysis by macrophages in culture, 8:13123 (J:US)
Biological Functions
Phagocytosis of particulate nickel compounds by rat peritoneal macrophages in vitro, 8:13190 (J:US)
Biological Localization
Degradation of connective tissue matrices by macrophages. III. Morphological and biochemical studies on extracellular, pericellular, and intracellular events in matrix proteolysis by macrophages in culture, 8:13123 (J:US)
MAGMA
Origin
Strontium isotopes in the Clear Lake Volcanics, 8:12191 (RA:US)
MAGMA SYSTEMS
Heat Extraction
Final report - Magma Energy Research Project, 8:12248 (R:US)
MAGNESIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Solvent Extraction
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
MAGNESIUM 24
Forbidden Transitions
Isospin mixing in ^{24}Mg, 8:13315 (R:US)
MAGNESIUM 24 TARGET
Proton Reactions
Restriction of the effective number of independent spin channels in a fluctuation analysis, 8:13317 (RA:SU:In Russian)
MAGNESIUM OXIDES
Crystal Doping
Incorporation of atomic carbon and hydrogen in high-melting oxide - nuclear-chemical, dilatometric and infrared spectroscopical investigations on C- and H-doped MgO and CaO-monocrystals, 8:12710 (R:DE:In German)
MAGNET COILS
Design
Design concept for the FED poloidal field coils using an internally cooled cable superconductor, 8:13491 (R:US)
MAGNETIC ANALYZERS
Calibration
Energy calibration of the TUNL dual-90° magnet analyzing system, 8:12915 (R:US)
MAGNETIC BREMSSTRAHLUNG
See SYNCHROTRON RADIATION
MAGNETIC COILS
See MAGNET COILS
MAGNETIC ENERGY STORAGE EQUIPMENT
Design
Rotary flux compressor: a new high-power compact energy store, 8:12448 (R:US)
Operation
Rotary flux compressor: a new high-power compact energy store, 8:12448 (R:US)
MAGNETIC FIELD RIPPLES
Scaling Laws
Neoclassical ripple transport in tokamaks, 8:13507 (J:AT)
MAGNETIC FIELDS
Computer Calculations
MULTIC program for computing three-dimensional magnetic fields of superconducting magnets, 8:12847 (R:SU:In Russian)
MAGNETIC LENS SPECTROMETERS
Beam Optics
Optical properties of the "Montpellier" spectrometer deduced from magnetic field measurement, 8:12968 (R:FR:In French)
MAGNETIC MONOPOLES
Detection
Annual progress report for the high-energy-physics program at Texas A and M University, December 1, 1981-December 1, 1982, 8:12947 (R:US)
MAGNETIC PROBES
Sensitivity
Efficient technique for magnetic analysis of non-circular, high-beta tokamak equilibria, 8:13505 (J:AT)
MAGNETIC REFRIGERATORS
Technology Assessment
Magnetic refrigeration: the basis for a new refrigeration technology. Los Alamos Mini-Review, 8:12851 (R:US)
MAGNETIC SPECTROMETERS
See also MAGNETIC LENS SPECTROMETERS
Beam Optics
Analysis of the spectrometer SPES 4 and study of an associated detection apparatus, 8:12927 (R:FR:In French)
On-Line Measurement Systems
Facility for measurements of fragmentation spectra of relativistic deuterons and alpha particles, 8:12921 (R:SU:In Russian)
Performance
Analysis of the spectrometer SPES 4 and study of an associated detection apparatus, 8:12927 (R:FR:In French)
MAGNETOHYDRODYNAMIC CHANNELS
See MHD CHANNELS
MAGNETOHYDRODYNAMIC GENERATORS
See MHD GENERATORS
MAHOGANY TREES
See TREES
MAINE
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Maine peat resource evaluation program, 8:11708 (RA:US)
State resource estimation: Maine, 8:11694 (RA:US)
MAIZE
Chemical Analysis
New analytical techniques for mycotoxins in complex organic matrices, 8:12757 (R:US)
Genetics
Detection of changes in maize DNA at the shrunken locus due to the intervention of Ds elements, 8:13125 (J:US)
MALIGNANCIES
See NEOPLASMS
MALONIC ACID
Crystal Structure
Crystal structure of nitromalonamide determined by means of neutron diffraction, 8:12805 (RA:DK:In Danish)
MAN
All of mankind, of any age or of either sex.
Radionuclide Kinetics
1976 Hanford americium exposure incident: overview and perspective, 8:13142 (R:US)
MANAGEMENT
See also NUCLEAR MATERIALS MANAGEMENT
Labor Relations
Leadership opportunities in the new age, 8:13099 (R:US)
MANGANESE
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

MANIOC
See CASSAVA
MANIPULATORS
Control Systems
Consolidated Fuel-Reprocessing Program. Servomanipulator control systems, 8:12840 (R:US)
Design
Consolidated Fuel-Reprocessing Program. ASM mechanical system, 8:12841 (R:US)
Industry-standard manipulator integrated maintenance system. Consolidated Fuel-Reprocessing Program, 8:12842 (R:US)
Operation
Industry-standard manipulator integrated maintenance system. Consolidated Fuel-Reprocessing Program, 8:12842 (R:US)
Performance
Advanced servomanipulator performance summary. Consolidated Fuel-Reprocessing Program, 8:12843 (R:US)
Performance Testing
Servomotor test stand. Consolidated Fuel-Reprocessing Program, 8:12844 (R:US)
Specifications
Advanced servomanipulator performance summary. Consolidated Fuel-Reprocessing Program, 8:12843 (R:US)
Test Facilities
Servomotor test stand. Consolidated Fuel-Reprocessing Program, 8:12844 (R:US)
MANNOMUSTINE
See ALKYLATING AGENTS
MANPOWER
Training
Training farmworkers for industrial jobs: a longitudinal study, 8:12466 (R:US)
MANUFACTURED BUILDINGS
See PREFABRICATED BUILDINGS
MANUFACTURING
Automation
Bendix CAD-CAM site plan, 8:13538 (R:US)
Computer-Aided Design
Bendix CAD-CAM site plan, 8:13538 (R:US)
MANUFACTURING FACILITIES
See INDUSTRIAL PLANTS
MANURES
Anaerobic Digestion
Demonstration of biomass-derived fuels for integrated energy farm, 8:12100 (R:US)
MANY-BODY PROBLEM
See also THREE-BODY PROBLEM
Resonating-Group Method
Algebraic realization of the resonating-group method for multichannel scattering problem in eight nucleons system, 8:13306 (RA:SU:In Russian)
MANY-DIMENSIONAL CALCULATIONS
More than four dimensions.
Computer Graphics
Use of color and motion for the display of multi-dimensional data, 8:13559 (R:US)
MAPPING
Computer Codes
LAMAP, the Los Alamos National Laboratory mapping code, 8:13554 (R:US)
MARCOULE PHENIX REACTOR
See PHENIX REACTOR
MARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
MARINE INSURANCE
See INSURANCE
MARINE VEHICLE ACCIDENTS
See ACCIDENTS
MARLEX
Equations of State
Simple EOS for linear (high-density) polyethylene (Marlex), 8:12724 (R:US)
MARYLAND
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
MASS DIFFERENCE
Quark Model
Research in elementary-particle physics. Progress report, May 1, 1982-April 30, 1983, 8:13250 (R:US)
MASSACHUSETTS
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Peat resource definition and utilization in Massachusetts, 8:11707 (RA:US)
MASSACHUSETTS INSTITUTE OF TECHNOLOGY ALC
See ALCATOR DEVICE
MASURIUM
See TECHNETIUM
MATERIALS
See also BIOLOGICAL MATERIALS
COMPOSITE MATERIALS
HAZARDOUS MATERIALS
ION EXCHANGE MATERIALS
MOLDING MATERIALS
PHASE CHANGE MATERIALS
POROUS MATERIALS
RADIOACTIVE MATERIALS
REACTOR MATERIALS
REINFORCED MATERIALS
SEMICONDUCTOR MATERIALS
SHIELDING MATERIALS
THERMONUCLEAR REACTOR MATERIALS
TOXIC MATERIALS
Fabrication
Division of Materials Science (DMS) meeting presentation, 8:12742 (R:US)
Research Programs
Department of Metallurgy and Materials research report, 1981-82, 8:12658 (R:GB)
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
Wear Resistance
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals, 8:11725 (RA:US)
MATERIALS (BIOLOGICAL)
See BIOLOGICAL MATERIALS
MATERIALS (COMPOSITE)
See COMPOSITE MATERIALS
MATERIALS HANDLING
Test Facilities
Research and development leading to the preparation of a gravity flow of solids media engineering databook for coal conversion and utilization processes. Phase I. Final technical report, 8:11752 (R:US)
MATERIALS HANDLING EQUIPMENT
See also REMOTE HANDLING EQUIPMENT
Stress Analysis
Structural analysis of the CDF transporter cart, 8:12917 (R:US)
MATERIALS (POROUS)
See POROUS MATERIALS
MATERIALS (REINFORCED)
See REINFORCED MATERIALS
MATERIALS (SEMICONDUCTOR)
See SEMICONDUCTOR MATERIALS
MATERIALS (SHIELDING)
See SHIELDING MATERIALS
MATERIALS WORKING
Covers metal and non-metal working.
Continuous production of strip by Rheocasting. Final report, August 16, 1978-September 30, 1981, 8:12663 (R:US)
Research Programs
Department of Metallurgy and Materials research report, 1981-82, 8:12658 (R:GB)
MEASURING INSTRUMENTS
Use of a more specific term is recommended.
See also DOSEMETERS
MONITORS

RADIATION DETECTORS
SPECTROMETERS
VISCOSIMETERS

Calibration
Challenge for metrology in the R and D environment, 8:12942 (R:US)
Evaluation of coordinate measuring machines, 8:13005 (R:US)

MEASURING METHODS
Use of a more specific term is recommended.
Challenge for metrology in the R and D environment, 8:12942 (R:US)

MECHANICAL VIBRATIONS
Monitoring
Vibration monitoring of ebullating pump at the H-Coal pilot plant, 8:11624 (R:US)

MEDICAL PERSONNEL
See also RADIOLOGICAL PERSONNEL
Occupational Safety
Exposure of pharmacy personnel to mutagenic antineoplastic drugs, 8:13130 (R:US)

MEHRZWECK-FORSCHUNGSREAKTOR
See MZFR REACTOR

MELANIN
Origin
Comparative action spectra for pyrimidine dimer formation in Cloudman S91 mouse melanoma and EMT6 mouse mammary carcinoma cells, 8:13162 (J:GB)

MELANOCYTES
See ANIMAL CELLS
MELANIN

MELTDOWN
Aerosols
Hydrogen production during fragmented debris/concrete interactions (PWR; BWR), 8:12419 (R:US)
After-Heat
Hydrogen production during fragmented debris/concrete interactions (PWR; BWR), 8:12419 (R:US)
After-Heat Removal
Effect of physical characteristics on heat transfer over a gas free-flowing interface, 8:12384 (R:DE:GE)
Experimental study of heat transfer in 1- and 2-layered fluid systems perfused by gas and containing internal heat sources, 8:12385 (R:DE:GE)
Computer Codes
Analysis of LWR degraded core accidents, 8:12435 (J:US)
Fission Product Release
Hydrogen production during fragmented debris/concrete interactions (PWR; BWR), 8:12419 (R:US)
Heat Transfer
Assessment of fuel-foaming potential during core-meltdown accidents, 8:12414 (R:US)
Hydraulics
Assessment of fuel-foaming potential during core-meltdown accidents, 8:12414 (R:US)
Risk Assessment
Degraded core aspects of Sandia's probabilistic and cost-benefits programs, 8:12437 (J:US)

MEMBRANES
Materials Testing
Prevention and control of LNG tanker spills with membrane barrier systems inside cargo tanks. Final technical report, October 1981-November 1982, 8:13027 (R:US)
Performance Testing
Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)

MERCURY
Abundance
Mercury in the sediments of Clear Lake, 8:12214 (RA:US)
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Gas Chromatography
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Prospecting
Faulting and ore controls at the Culver-Baer mine, Sonoma County, California, 8:12196 (RA:US)

MERCURY IODIDES
Electrical Properties
Characterization of single-crystal mercuric iodide (HgI_2) using thick detector structures, 8:12731 (R:US)

MESON RESONANCES
See also A RESONANCES
Mass Spectra
SU(3) lattice Monte Carlo calculation of the glueball mass spectrum, 8:13269 (R:DE)

MESON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET

METABOLITES
Biosynthesis
Nature and mechanism of induction of mutations. Annual progress report, October 1, 1981-August 1, 1982, 8:13103 (R:US)

METAL BUILDINGS
See PREFABRICATED BUILDINGS

METAL CASTINGS
See CASTINGS

METAL INDUSTRY
Energy Conservation
Alternatives of the industrial energy planner, 8:12616 (RA:US)
Waste Heat Utilization
Alternatives of the industrial energy planner, 8:12616 (RA:US)

METAL-INSULATOR-SEMICONDUCTOR SOLAR CELLS
See MIS SOLAR CELLS

METALS
See also ALKALI METALS
ALUMINIUM
ANTIMONY
BISMUTH
CADMIUM
GALLIUM
GERMANIUM
LEAD
MERCURY
RARE EARTHS
THALLIUM
TIN
TRANSITION ELEMENTS
ZINC
Excretion
1976 Hanford americium-exposure incident: urinary excretion of trace metals during DTPA treatments, 8:13151 (R:US)
Mass Spectroscopy
Isotope-dilution analyses of the metallic elements, 8:12752 (R:US)
Materials Testing
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
Materials Working
Continuous production of strip by Rheocasting. Final report, August 16, 1978-September 30, 1981, 8:12663 (R:US)
Monitoring
On-line liquid-effluent monitoring of sewage at Lawrence Livermore National Laboratory, 8:13092 (R:US)
Physical Radiation Effects
Department of Metallurgy and Materials research report, 1981-82, 8:12658 (R:GB)
Hardening of irradiated alloys due to the simultaneous formation of vacancy and interstitial loops, 8:12661 (R:US)
Theoretical relationships between creep and swelling by point defect absorption during irradiation, 8:12660 (R:US)
Research Programs
Department of Metallurgy and Materials research report, 1981-82, 8:12658 (R:GB)
Separation Processes
Prototype tramp-metal separator: a summary of test results, 8:12633 (R:US)
Surface Coating
Coating Processes Group progress report, September-October 1982, 8:12690 (R:US)
Surface Finishing
Mirror finishing of metals using the electrolytic-abrasive mirror-finishing method, 8:12702 (TJ:US)

METAL-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS
METEORITES
Age Estimation
Cosmic clocks, 8:13228 (R:US)
METEOROLOGY
Data Acquisition
Meteorological aspects of the transport of energy, 8:12477 (RA:CH)
Data Analysis
Analyses of meteorological and insolation data useful for solar energy system design, 8:12008 (RA:CH)
Meetings
Energy and special applications programme, report No. 2 (1981). Papers presented at the WMO technical conference on meteorology and energy, 8:11999 (R:CH)
Research Programs
Comes action in solar meteorology, 8:12007 (RA:CH)
Solar and wind energy research in connexion to community and building planning, 8:12010 (RA:CH)
METER WAVE RADIATION
See RADIOWAVE RADIATION
METHANATION
Catalysts
Fuel oil substitution by enriched medium Btu gas produced from coal in Winkler fluidized gasifiers, 8:11590 (RA:US)
Methanol synthesis, 8:11984 (RA:US)
METHANE
Biosynthesis
Demonstration of landfill gas-enhancement techniques in landfill simulators, 8:11959 (R:US)
Charged-Particle Transport
Development of a multiwire proportional chamber for nanodosimetry measurement of the energy deposition of alpha particles in smallest sensitive volumina, 8:12964 (R:DE:In German)
Impurities
Development of the utilization of combustible gas produced in existing sanitary landfills: investigation of effects of air inclusion, 8:12630 (R:US)
Production
Continued development of a peat biogasification process, 8:11607 (RA:US)
Fuel-cell power-system configurations utilizing waste-derived fuels. Summary of final technical report for the period September 1977-August 1978, 8:12525 (R:US)
Sorption
Study of hydrocarbon: shale interaction. Progress report 315, July 1-September 30, 1979, 8:11824 (R:US)
Steam Reformer Processes
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)
Synthesis
Investigation of gasification of biomass in the presence of catalysts, 8:12067 (R:US)
Uses
Fuel-cell power-system configurations utilizing waste-derived fuels. Summary of final technical report for the period September 1977-August 1978, 8:12525 (R:US)
METHANOL
Chemical Preparation
Method for the preparation of a gaseous fuel (Dutch patent), 8:11991 (TG:GB)
Cost
Industrial potentials of coal-alcohol slurry fuels, 8:11763 (RA:US)
Decomposition
Kinetics and mechanism of methanol decomposition over zinc oxide, 8:11982 (R:US)
Meetings
Biomass-to-methanol specialists' workshop, 8:11983 (R:US)
Production
Comparison of coal and wood as feedstocks for methanol manufacture, 8:11658 (RA:US)
Large wood to methanol plants, 8:11987 (RA:US)
Packaged plants (Economic advantages modular methanol plants), 8:11986 (RA:US)
Peat as a feedstock to the KBW gasification process, 8:11659 (RA:US)
Technical and economic assessment of liquid-fuel production from biomass, 8:12074 (RA:US)
Synthesis
Biomass gasification developments, 8:11990 (RA:US)
Biomass-to-methanol specialists' workshop, 8:11983 (R:US)
Chem Systems' Liquid Phase Methanol process, 8:11985 (RA:US)
Methanol from wood and peat, 8:11989 (RA:US)
Methanol production from fermentor off-gases. Final report, July 1, 1981-June 30, 1982 (CDH-methanol process), 8:11972 (R:US)
Methanol synthesis, 8:11984 (RA:US)
Pressurized fluidized bed gasifier in the synthesis of methanol from wood, 8:11988 (RA:US)
Pressurized oxygen blown fluidized bed gasification of wood, 8:11967 (RA:US)
METHANOL FUELS
Pure methanol, methanol-water mixtures, or methanol with additives; for methanol-gasoline mixtures, use GASOHOL.
Forecasting
Outlook for methanol in Brazil, 8:12510 (RA:US)
METHANOL PLANTS
Large wood to methanol plants, 8:11987 (RA:US)
Cost
Pressurized fluidized bed gasifier in the synthesis of methanol from wood, 8:11988 (RA:US)
Technical and economic assessment of liquid-fuel production from biomass, 8:12074 (RA:US)
Design
Packaged plants (Economic advantages modular methanol plants), 8:11986 (RA:US)
Economics
Packaged plants (Economic advantages modular methanol plants), 8:11986 (RA:US)
Environmental Impacts
Alcohols from biomass: state-of-knowledge survey of environmental, health and safety aspects, 8:12045 (R:US)
Performance
Chem Systems' Liquid Phase Methanol process, 8:11985 (RA:US)
Process Development Units
Biomass gasification developments, 8:11990 (RA:US)
METHOXY RADICALS
Laser Spectroscopy
Laser spectroscopy of combustion intermediates, 8:12829 (R:US)
METHYL ALCOHOL
See METHANOL
METHYL ETHER
Chemical Preparation
Method for the preparation of a gaseous fuel (Dutch patent), 8:11991 (TG:GB)
METHYL METHANESULFONATE
Mutagen Screening
Screening of mutagens by inhibition of DNA synthesis, 8:13191 (BA:US)
METHYL-FUEL
See ALCOHOLS
METHANOL
METROPOLITAN AREAS
See URBAN AREAS
MEXICO
Energy Conservation
Energy conservation in Mexico, 8:12547 (RA:CH)
MFTF DEVICES
Prior to October 1977, MX DEVICES was used to index this concept.
Vacuum Systems
Changing MFTF vacuum environment, 8:13498 (R:US)
MHD CHANNELS
Design
MHD generator component development. Quarterly report, January-March 1980, 8:12515 (R:US)

MHD GENERATOR AERL MARK VI
Oil-fired MHD test facility at Avco Everett Research Laboratory, Massachusetts.
Operation
MHD generator component development. Quarterly report, January-March 1980, 8:12515 (R:US)
MHD GENERATOR CFFF
Coal Fired Flow Facility for MHD generator component testing at Tullahoma, Tenn.
Operation
MHD-Coal-Fired Flow Facility. Quarterly technical progress report, July-September 1981, 8:12513 (R:US)
MHD Coal-Fired Flow Facility. Quarterly technical progress report, October-December 1981, 8:12514 (R:US)
Testing
MHD-Coal-Fired Flow Facility. Quarterly technical progress report, July-September 1981, 8:12513 (R:US)
MHD Coal-Fired Flow Facility. Quarterly technical progress report, October-December 1981, 8:12514 (R:US)
MHD GENERATOR UTSI
Coal-fired MHD generator at University of Tennessee Space Institute.
Operation
MHD-Coal-Fired Flow Facility. Quarterly technical progress report, July-September 1981, 8:12513 (R:US)
MHD Coal-Fired Flow Facility. Quarterly technical progress report, October-December 1981, 8:12514 (R:US)
Testing
MHD-Coal-Fired Flow Facility. Quarterly technical progress report, July-September 1981, 8:12513 (R:US)
MHD Coal-Fired Flow Facility. Quarterly technical progress report, October-December 1981, 8:12514 (R:US)
MHD GENERATORS
See also MHD GENERATOR AERL MARK VI
Research Programs
Resources and development plans of Bharat Heavy Electricals Limited (BHEL) for the utilization of low-rank coals (India), 8:11725 (RA:US)
MHD POWER PLANTS
Oxygen Enrichment
Methods of reducing energy consumption of the oxidant-supply system for MHD/steam power plants, 8:12516 (R:US)
MICELLAR-POLYMER FLOODING
See MICROEMULSION FLOODING
MICHIGAN
Energy Demand
Michigan energy futures: requirements to the year 2000, 8:12482 (R:US)
Geological Surveys
State resource estimation: Michigan, 8:11695 (RA:US)
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Peat resource estimate in Michigan, 8:11709 (RA:US)
State resource estimation: Michigan, 8:11695 (RA:US)
MICROBIAL ENHANCED OIL RECOVERY
See MICROBIAL EOR
MICROBIAL EOR
Feasibility Studies
Microbial enhancement of oil recovery, 8:11794 (RA:US)
Research Programs
Microbial enhancement of oil recovery, 8:11794 (RA:US)
MICROBIAL FLORA
See MICROORGANISMS
MICROBIAL PROCESSES
See BIOCONVERSION
MICROCOMPUTERS
See MICROPROCESSORS
MICROEMULSION FLOODING
Surface Tension
Magnitude and role of dynamic interfacial effects in low tension flooding, 8:11806 (J:US)
MICROFLORA
See MICROORGANISMS
MICROORGANISMS
Microbial enhancement of oil recovery, 8:11794 (RA:US)
MICROPROCESSORS
Seven technologies for the eighties, 8:12470 (R:US)
Design
Portable instrumentation for processing information from selected personnel neutron dosimetry detectors, 8:13372 (RA:US)
Equipment Interfaces
Erigone bus study, 8:13543 (R:XC)
Programming
Tools for developing software for different types of microprocessors, to be used, in particular, for the acquisition and processing of nuclear data, 8:13542 (R:FR:In French)
MICROSEISMIC MONITORING
See ACOUSTIC MONITORING
MICROWAVE AMPLIFIERS
Research Programs
Development program for a 200-kW, c-w gyrotron. Quarterly report No. 10, October-December 1981, 8:13489 (R:US)
MICROWAVE RADIATION
Biological Effects
Health implications of exposure to radiofrequency/microwave energies, 8:13195 (J:GB)
MIGRATION
Mathematical Models
Introduction to modeling fish migratory behavior, 8:13102 (R:US)
MIGRATION (RADIONUCLIDE)
See RADIONUCLIDE MIGRATION
MILITARY EQUIPMENT
Fuel Cells
Defense applications of fuel cells, 8:12535 (BA:US)
MILITARY FACILITIES
Geothermal Resources
Geothermal development on military lands: US Navy contract regulations from a developer's point of view, 8:12228 (RA:US)
Laws and regulations governing procurement, 8:12227 (RA:US)
Opportunities for industry in the development of geothermal energy at US military installations, 8:12184 (RA:US)
Special requirements and procedures for geothermal development on Navy lands, 8:12226 (RA:US)
Resource Development
Laws and regulations governing procurement, 8:12227 (RA:US)
MILL TAILINGS
Coverings
Consolidation theory and its applicability to the dewatering and covering of uranium-mill tailings, 8:11924 (R:US)
Handbook for the design, selection, and construction of a rock cover for retired uranium-mill tailings, 8:11902 (R:US)
Decontamination
Remedial actions at inactive uranium mill tailings sites, 8:11920 (BA:US)
Radioactive Waste Disposal
Remedial actions at inactive uranium mill tailings sites, 8:11920 (BA:US)
Water Removal
Consolidation theory and its applicability to the dewatering and covering of uranium-mill tailings, 8:11924 (R:US)
MILLING MACHINES
Mass Transfer
Transport in rotary drums and ball mills, 8:12849 (R:DE:In German)
MINE-MOUTH GENERATING PLANTS
See COAL MINES
FOSSIL-FUEL POWER PLANTS
MINERAL ACIDS
See INORGANIC ACIDS

MINERAL WASTES
Hydraulic Transport
Returning coal waste underground. Phase I: report addendum, 8:11732 (R:US)
MINERALS
See also FELDSPARS
ZEOLITES
Phase Transformations
Overburden characterization and post-burn study of the Hoe Creek, Wyoming underground coal gasification site and comparison with the Hanna, Wyoming site, 8:11622 (R:US)
MINERS
Medical Surveillance
Radiation hazards in mining: control, measurement, and medical aspects, 8:13170 (B:US)
MINES
See also COAL MINES
URANIUM MINES
Radiation Hazards
Radiation hazards in mining: control, measurement, and medical aspects (Lead abstract), 8:13170 (B:US)
MINING EQUIPMENT
See also BUCKET WHEEL EXCAVATORS
ROOF BOLTS
Data Acquisition Systems
Power shovel data accumulator and display. Final report, September 1982, 8:11733 (R:US)
Manufacturers
Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA:US)
Monitoring
Power shovel data accumulator and display. Final report, September 1982, 8:11733 (R:US)
Power Supplies
Power supplies, 8:11737 (R:US)
Specifications
Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA:US)
Technology Assessment
Assessment of benefit-cost analysis for coal-extraction R and D, 8:11738 (R:US)
MINNESOTA
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
State resource estimation: Minnesota, 8:11696 (RA:US)
Status of the Minnesota peat inventory project (April, 1982), 8:11710 (RA:US)
MINORITY GROUPS
See also LOW INCOME GROUPS
Energy Expenses
Impact of energy pricing upon the Hispanic community, 8:12464 (R:US)
MIRROR FUSION TEST FACILITY
See MFTF DEVICES
MIS SOLAR CELLS
Electric Contacts
Competitive investigations of oxidation processes for silicon MIS-solar cells. Final report, 8:12058 (R:XE)
Oxidation
Competitive investigations of oxidation processes for silicon MIS-solar cells. Final report, 8:12058 (R:XE)
MISCIBLE FLOODING
See MISCIBLE-PHASE DISPLACEMENT
MISCIBLE-PHASE DISPLACEMENT
See also CARBON DIOXIDE INJECTION
MICROEMULSION FLOODING
Bench-Scale Experiments
Determination of miscibility pressure by direct-observation method. Quarterly report, July 1-September 30, 1982, 8:11797 (R:US)
MISGURNUS
See FISHES
MISSISSIPPI
Coal Deposits
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
MISSOURI
Coal Deposits
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
MIXED OXIDE FUEL FABRICATION PLANTS
Automation
Safeguards through secure automated fabrication, 8:11937 (R:US)
Nuclear Materials Management
Loss detection and alarm resolution in processing special nuclear material, 8:11941 (R:US)
Safeguards
Safeguards through secure automated fabrication, 8:11937 (R:US)
MIXTURES
See also SLURRIES
Thermodynamic Properties
Thermodynamic properties of strongly nonideal fluid mixtures from an extended quasi-chemical theory, 8:12792 (R:US)
MMS
See METHYL METHANESULFONATE
MODELS (PLASMA)
See PLASMA SIMULATION
MOLDING MATERIALS
Synthesis
Synthesis and characterization of diallyl phthalate prepolymers, 8:12722 (R:US)
MOLDS
See FUNGI
MOLECULAR SIEVES
Catalytic Effects
Liquid-hydrocarbon fuels from syngas. Quarterly report, March 1982-May 1982, 8:11963 (R:US)
MOLLUSCS
Population Dynamics
Ecological studies of wood-boring bivalves in the vicinity of the Oyster Creek Nuclear Generating Station. Progress report, March-May 1982, 8:13175 (R:US)
Predator-Prey Interactions
Model of naticid gastropod predator-prey coevolution, 8:13073 (R:US)
MOLTEN CARBONATE FUEL CELLS
Prior to June 1980 this information was indexed with the descriptors HIGH-TEMPERATURE FUEL CELLS + MOLTEN SALTS + CARBONATES.
Fuel Systems
Electricity generation from coal using fuel cells: preliminary systems analysis, 8:12537 (BA:US)
Technology Assessment
Molten carbonate fuel cells: technology status, 8:12534 (BA:US)
MOLTEN METAL-WATER REACTIONS
Fragmentation
Heat transfer and fragmentation during contact between a gas-covered melt and cooling liquid, 8:12386 (R:DE:GE)
Heat Transfer
Heat transfer and fragmentation during contact between a gas-covered melt and cooling liquid, 8:12386 (R:DE:GE)
MOLTEN SALT COAL GASIFICATION PROCESS
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)
Economic Analysis
Coal-gasification basic research and costs studies. Quarterly report No. 4, 8:11620 (R:US)

MOLTEN SALT PROCESS (ATOMIC INTERNATIONAL
See MOLTEN SALT COAL GASIFICATION PROCESS
MOLTEN SALT PROCESS (KELLOGG)
See KELLOGG PROCESS
MOLYBDATES
Specific compounds should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Electrical Properties
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
Grain Orientation
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
MOLYBDENUM
Absorption Spectroscopy
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Fracture Properties
X-ray topographic fractography of single crystals of molybdenum and niobium, 8:12667 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)
Surface Properties
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R:US)
MOLYBDENUM 92
Energy Levels
Systematics of odd nucleus magnetic moments. Spin of the 4.48 MeV ^{92}Mo state, 8:13331 (RA:SU:In Russian)
MOLYBDENUM 92 TARGET
Nitrogen 14 Reactions
Isotopic separation device on-line with a heavy ion accelerator, 8:12926 (R:FR:In French)
MOLYBDENUM COMPLEXES
Reduction
Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_3Mo_2Cl_8H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters, 8:12785 (R:US)
Structural Chemical Analysis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_3Mo_2Cl_8H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters, 8:12785 (R:US)
Synthesis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_3Mo_2Cl_8H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters, 8:12785 (R:US)
MOLYBDENUM SELENIDES
Electrical Properties
Electrical properties of WSe_2, WS_2, $MoSe_2$, MoS_2, and their use as photoanodes in a semiconductor/liquid junction solar cell, 8:12062 (R:US)
Hexagonal Lattices
Detailed photocurrent spectroscopy of the semiconducting group VI transition metal dichalcogenides, 8:12811 (J:US)
Photocurrents
Detailed photocurrent spectroscopy of the semiconducting group VI transition metal dichalcogenides, 8:12811 (J:US)
Superconductivity
Superconductivity and low-temperature phases of Cu/sub x/Mo_6Se_8, 8:12738 (R:US)
MOLYBDENUM SULFIDES
Electrical Properties
Electrical properties of WSe_2, WS_2, $MoSe_2$, MoS_2, and their use as photoanodes in a semiconductor/liquid junction solar cell, 8:12062 (R:US)
Hexagonal Lattices
Detailed photocurrent spectroscopy of the semiconducting group VI transition metal dichalcogenides, 8:12811 (J:US)
Photocurrents
Detailed photocurrent spectroscopy of the semiconducting group VI transition metal dichalcogenides, 8:12811 (J:US)
MONAZITES
Corrosion Resistance
Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance, 8:11867 (R:US)
Leachates
Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance, 8:11867 (R:US)
MONITORING (RADIATION)
See RADIATION MONITORING
MONITORS
See also BEAM MONITORS
RADIATION MONITORS
Design
Monitors 1980: now there are two, 8:12443 (J:US)
MONITORS (REACTOR)
See REACTOR CONTROL SYSTEMS
MONOCRYSTALS
Showers
Effect of the crystal structure of the medium on the evolution of the electromagnetic shower, 8:13262 (RA:SU:In Russian)
X-Ray Diffraction
Synchrotron X-ray diffraction from liquid crystals, perfect crystals and perfect liquid crystals, 8:13375 (RA:DK:In Danish)
MONOSACCHARIDES
See also SORBITOL
Chemical Reactions
ESR study of the attack of photolytically produced hydroxyl radicals on α-methyl-D-glucopyranoside in aqueous solution, 8:12822 (J:US)
Electrochemistry
Survey of the electrochemistry of some biomass-derived compounds, 8:12097 (R:US)
MONTANA
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
MONTMORILLONITE
Sorptive Properties
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
MORDENITE
Recycling
Recycle of iodine-loaded silver mordenite by hydrogen reduction, 8:11900 (R:US)
Regeneration
Recycle of iodine-loaded silver mordenite by hydrogen reduction, 8:11900 (R:US)
MT ST HELENS
Ground Motion
Observations of volcanic tremor at Mt. St. Helens volcano, 8:13206 (R:US)
MULTI-CHANNEL ANALYZERS
Trigger Circuits
Simple multifunction discriminator for multichannel triggers, 8:12973 (R:US)

MULTIWIRE DRIFT CHAMBERS
See DRIFT CHAMBERS
MULTIWIRE PROPORTIONAL CHAMBERS
See also DRIFT CHAMBERS
Microdosimetry
Development of a multiwire proportional chamber for nanodosimetry measurement of the energy deposition of alpha particles in smallest sensitive volumina, 8:12964 (R:DE:In German)
Particle Identification
Measurement methods for high energy particle identification in gaseous mixture detectors, 8:12972 (R:FR:In French)
Preamplifiers
Measurement methods for high energy particle identification in gaseous mixture detectors, 8:12972 (R:FR:In French)
MUNICIPAL BUILDINGS
See PUBLIC BUILDINGS
MUNICIPAL WASTES
Cocombustion
Co-utilization of municipal solid waste and wood residues for small-scale resource recovery: a preliminary assessment, 8:12637 (R:US)
Combustion
Energy recovery for Kent and Sussex Counties, Delaware: Phase II study report, 8:12629 (R:US)
Energy Recovery
Energy recovery for Kent and Sussex Counties, Delaware: Phase II study report, 8:12629 (R:US)
Separation Processes
Prototype tramp-metal separator: a summary of test results, 8:12633 (R:US)
MUON PAIRS
Pair Production
Dimuon production in hadronic interactions, 8:13258 (R:US)
Transverse momentum spectra of dimuons produced in hadronic interactions and comparison with QCD, 8:13259 (R:US)
MUONIC ATOMS
Hyperfine Structure
Nuclear chemistry project. Progress report, April 1, 1982-March 31, 1983, 8:13349 (R:US)
Multipole Transitions
Radiationless excitation of the nucleus in the ^{238}U muonic atoms, 8:13241 (RA:SU:In Russian)
MUONS
Pair Production
Forward dimuons from πN interactions at Fermilab: design and construction of a scintillation-counter hodoscope, 8:13278 (R:US)
MUSCULAR TISSUE
See TISSUES
MUSEUMS
See EDUCATIONAL FACILITIES
MUTAGEN SCREENING
Health effects of combustion-generated soot and polycyclic aromatic hydrocarbons: human cell studies. Progress report, 1977-1983, 8:13181 (R:US)
Data Analysis
Parametric statistical methods and sample-size considerations for dominant lethal experiments: the use of clustering to achieve approximate normality, 8:13179 (R:US)
MUTAGENESIS
Biochemistry
Health effects of combustion-generated soot and polycyclic aromatic hydrocarbons: human cell studies. Progress report, 1977-1983, 8:13181 (R:US)
Response Modifying Factors
Mass and mutagenicity balances in chemical fractionations, 8:13178 (R:US)
MUTAGENS
See also METHYL METHANESULFONATE
Biological Effects
Measurement of unscheduled synthesis by autoradiography, 8:13132 (BA:US)
Biological Pathways
Nature and mechanism of induction of mutations. Annual progress report, October 1, 1981-August 1, 1982, 8:13103 (R:US)
Genetic Effects
Measurement of sister chromatid exchange in mammalian cells, 8:13192 (BA:US)
Metabolic Activation
Measurement of sister chromatid exchange in mammalian cells, 8:13192 (BA:US)
Screening of mutagens by inhibition of DNA synthesis, 8:13191 (BA:US)
Metabolites
Nature and mechanism of induction of mutations. Annual progress report, October 1, 1981-August 1, 1982, 8:13103 (R:US)
Toxicity
Session X: regulatory risk assessment, 8:13187 (BA:US)
MUTATIONS
See also GENE MUTATIONS
Genetic Effects
Three mutations in Zea mays affecting zein accumulation: a comparison of zein polypeptides, in vitro synthesis and processing, mRNA levels, and genomic organization, 8:13106 (J:US)
MWPC
See MULTIWIRE PROPORTIONAL CHAMBERS
MX DEVICES
See MFTF DEVICES
MZFR REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)

N

NAL SYNCHROTRON
See FERMILAB ACCELERATOR
NAPHTHALENE
Solubility
Supercritical behavior in multicomponent system (Solubility in CO_2 or C_2H_4; pressure and concentration dependence), 8:11635 (RA:US)
NAPHTHOLS
Thermal Degradation
Thermolysis of model compounds for coal. 2. Condensation and hydrogen transfer during thermolysis of naphthols, 8:11665 (J:US)
NAPHTHOLS-ALPHA
See NAPHTHOLS
NAPHTHOLS-BETA
See NAPHTHOLS
NATIONAL ACCELERATOR LABORATORY
See FERMILAB ACCELERATOR
NATIONAL ENERGY SECURITY CORPORATION
See SYNTHETIC FUELS CORPORATION
NATIONAL ENVIRONMENTAL POLICY ACT
NEPA process and direct coal liquefaction constraint or opportunity, 8:11594 (RA:US)
NATIONAL REACTOR TESTING STATION
See IDAHO NATIONAL ENGINEERING LABORATORY
NATIONAL SYNCHROTRON LIGHT SOURCE
See NSLS
NATURAL BRIDGES NATIONAL MONUMENT
Photovoltaic Power Supplies
Power processing subsystems for the 100-kWp solar-photovoltaic-power system at the Natural Bridges National Monument in Utah, 8:12110 (R:US)
NATURAL GAS
See also LIQUEFIED NATURAL GAS
Burners
Investigations and experiments by SNAM on the interchangeability of gases (From different sources and

mixtures or additions of other listed gases; various indices compared), 8:11823 (TG:GB)
Chemical Composition
Investigations and experiments by SNAM on the interchangeability of gases (From different sources and mixtures or additions of other listed gases; various indices compared), 8:11823 (TG:GB)
Combustion Properties
Investigations and experiments by SNAM on the interchangeability of gases (From different sources and mixtures or additions of other listed gases; various indices compared), 8:11823 (TG:GB)
Cost
Commercial energy costs for SOLCOST Data Bank cities, winter 1981-1982, 8:12014 (R:US)
Fuel Substitution
Makret place economics and coal conversions (Cents/million Btu; 1975 to 1981), 8:12268 (RA:US)
Interchangeability
Investigations and experiments by SNAM on the interchangeability of gases (From different sources and mixtures or additions of other listed gases; various indices compared), 8:11823 (TG:GB)
Prices
Industrial potentials of coal-alcohol slurry fuels, 8:11763 (RA:US)
Makret place economics and coal conversions (Cents/million Btu; 1975 to 1981), 8:12268 (RA:US)
Production
Low-rank coal exploitation and utilization in east European countries (USSR; 1950 to 1979), 8:11734 (RA:US)
Shortages
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)
Specifications
Investigations and experiments by SNAM on the interchangeability of gases (From different sources and mixtures or additions of other listed gases; various indices compared), 8:11823 (TG:GB)
Windfall Profits Tax
Incidence and effects of a windfall profit tax on natural gas, 8:11819 (R:US)

NATURAL GAS APPLIANCES
See GAS APPLIANCES

NATURAL GAS DEPOSITS
Exploration
Appraisal of landsat lineaments as faults in western Kentucky. Final report, 8:11816 (R:US)
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R:US)
Geologic Faults
Appraisal of landsat lineaments as faults in western Kentucky. Final report, 8:11816 (R:US)
Geologic History
Approximation of continuity of lenticular Mesaverde sandstone lenses, utilizing close-well correlations, Piceance Basin, northwest, Colorado. Western Gas Sands Project, 8:11817 (R:US)
Stratigraphy
Approximation of continuity of lenticular Mesaverde sandstone lenses, utilizing close-well correlations, Piceance Basin, northwest, Colorado. Western Gas Sands Project, 8:11817 (R:US)

NATURAL GAS INDUSTRY
Data Compilation
Natural gas annual, 1981, 8:11818 (R:US)
Fuel Cycle
Comparing the health and environmental hazards of different energy systems, 8:13100 (R:US)
Manpower
Forecasts of on-site and off-site occupational requirements for energy-construction developments in the United States, 1982 to 2000, 8:12465 (R:US)
Statistics
Wyoming's oil and gas industry. Public information circular No. 17, 8:11788 (R:US)

NATURAL GAS WELLS
Environmental Impact Statements
Resumption of exploratory drilling operations by Texaco, Inc.: state oil and gas leases - PRC 2725.1 (Jade Prospect), PRC 2206.1 (Anita Prospect), PRC 2955.1 (Refugio Prospect), Santa Barbara County. Final environmental impact report, 8:13101 (R:US)
Productivity
Study of hydrocarbon: shale interaction. Progress report 315, July 1-September 30, 1979, 8:11824 (R:US)

NEBRASKA
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)

NEGATONS
See ELECTRONS

NEGATRONS
See ELECTRONS

NEODYMIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

NEODYMIUM COMPOUNDS
See also NEODYMIUM FLUORIDES
Hydrolysis
Thermodynamic properties of chemical species in nuclear waste, 8:12825 (R:US)
Solubility
Thermodynamic properties of chemical species in nuclear waste, 8:12825 (R:US)

NEODYMIUM FLUORIDES
Crystal Structure
Structure of NdF_3, 8:12777 (RA:DK:In Danish)
Neutron Diffraction
Structure of NdF_3, 8:12777 (RA:DK:In Danish)

NEON 20 REACTIONS
One-Nucleon Transfer Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)

NEOPLASMS
See also CARCINOMAS
LEUKEMIA
Radioinduction
DNA damage and carcinogenesis, 8:13172 (BA:US)
Estimation of the cumulative exposure to uranium mine atmospheres by in vivo measurements of lead-210 in the skull, 8:13401 (BA:US)

NEPA
See NATIONAL ENVIRONMENTAL POLICY ACT

NEPTUNIUM
Redox Potential
Thermodynamic properties of chemical species in nuclear waste, 8:12825 (R:US)

NEPTUNIUM 237
Fission Ratio
Spectral and dosimetric characteristics of a moderated-neutron calibration facility, 8:13399 (RA:US)

NEPTUNIUM COMPLEXES
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)

NETWORKS (COMPUTER)
See COMPUTER NETWORKS

NEUTRAL ATOM BEAM INJECTION
Ballooning Instability
Neutral beam effects on tokamak ballooning mode stability, 8:13523 (J:GB)

NEUTRAL BEAM SOURCES
Neutron Emission
Generation of DT and DD neutrons from high-power neutral-beam dumps, 8:13514 (J:US)
Radiation Streaming
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R:US)
Reviews
ORNL neutral-beam program in 1978, 8:13490 (R:US)

NEUTRINO-ELECTRON INTERACTIONS
See also ANTINEUTRINO-ELECTRON INTERACTIONS
Elastic Scattering
Measurement of nu/sub e/ and anti nu/sub e/ elastic scattering as a test of the standard model, 8:13253 (R:US)
NEUTRINO-PROTON INTERACTIONS
See also ANTINEUTRINO-PROTON INTERACTIONS
Particle Production
Study of the antivsub(μ)p interactions with a liquid hydrogen sensitive target surrounded with a Ne-H_2 mixture, 8:13261 (R:FR:In French)
NEUTRON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
NEUTRON REACTIONS
NEUTRON CAPTURE
See NEUTRON REACTIONS
NEUTRON DETECTION
Collimators
Numerical modeling of a fast-neutron collimator for the Alcator A fusion device, 8:13474 (R:US)
NEUTRON DETECTORS
See also FISSION FOIL DETECTORS
HE-3 COUNTERS
PROTON RECOIL DETECTORS
Calibration
Eighth DOE workshop on personnel neutron dosimetry (Lead abstract), 8:13393 (R:US)
Comparative Evaluations
Use of a D_2O moderated Cf-252 source for dosimeter testing and calibrating, 8:13396 (RA:US)
Design
Experience and values in multi-dosimeter techniques, 8:12988 (RA:US)
Hadron personnel monitoring around high-energy proton accelerators, 8:12981 (RA:US)
Pocket neutron rem meter, 8:12980 (RA:US)
Portable instrumentation for processing information from selected personnel neutron dosimetry detectors, 8:13372 (RA:US)
Wide energy range Rem response personnel neutron dosimeter, 8:12985 (RA:US)
Energy Dependence
Investigation of the energy dependence of the equivalent dose rate ludication protection purposes, 8:12956 (RA:DE:In German)
Performance
Dosimetric properties of moderator-type neutron detectors, 8:12955 (RA:DE:In German)
Use of a D_2O moderated Cf-252 source for dosimeter testing and calibrating, 8:13396 (RA:US)
Quality Control
Experience and values in multi-dosimeter techniques, 8:12988 (RA:US)
Sensitivity
Pocket neutron rem meter, 8:12980 (RA:US)
NEUTRON DIFFUSION EQUATION
Finite Difference Method
Iterative solutions of finite difference diffusion equations, 8:12338 (R:IN)
Numerical Solution
Iterative solutions of finite difference diffusion equations, 8:12338 (R:IN)
NEUTRON DOSIMETRY
Albedo-Neutron Dosemeters
State of the art in Albedo-neutron dosimetry, 8:12958 (RA:DE:In German)
Benchmarks
Results of an international comparitive evaluation of neutron dosemeters for personnel monitoring, 8:13383 (RA:DE:In German)
Calibration
Analysis of neutron room return, 8:13398 (RA:US)
DOE Neutron Dosimetry Upgrade Program, 8:13394 (RA:US)
Spectral and dosimetric characteristics of a moderated-neutron calibration facility, 8:13399 (RA:US)
Data Processing
Portable instrumentation for processing information from selected personnel neutron dosimetry detectors, 8:13372 (RA:US)
Energy Dependence
Energy dependence of neutron dosemeters for personnel monitoring, 8:12957 (RA:DE:In German)
Etching
Improvement of electrochemical etching technique in neutron dosimetry, 8:13382 (RA:DE:In German)
Evaluation
Personnel neutron dosimeters based on organic polymers, 8:12979 (RA:US)
Fission Neutrons
Improvement of electrochemical etching technique in neutron dosimetry, 8:13382 (RA:DE:In German)
Meetings
Eighth DOE workshop on personnel neutron dosimetry (Lead abstract), 8:13393 (R:US)
Neutron Detectors
Dosimetric properties of moderator-type neutron detectors, 8:12955 (RA:DE:In German)
Program Management
DOE Neutron Dosimetry Upgrade Program, 8:13394 (RA:US)
Proportional Counters
Use of a helium-3 filled proportional counter as a sensitive dose or dose equivalent meter, 8:12960 (RA:DE)
Wall Effects
Calibration of neutron dosimetry techniques for use in reactor buildings, 8:12991 (RA:US)
NEUTRON MATTER
See NUCLEAR MATTER
NEUTRON MONITORS
Energy Dependence
Energy dependence of neutron dosemeters for personnel monitoring, 8:12957 (RA:DE:In German)
NEUTRON REACTIONS
Capture
Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R:NL)
Cross Sections
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R:US)
Direct Reactions
Direct process contribution into the hard component of the $^{113}In(n,n')$ reaction spectra, 8:13324 (RA:SU:In Russian)
Elastic Scattering
Algebraic version of resonating-group method and elastic scattering plases of the $^3He(n, n)^3He$, $^3H(p, p)^3H$, $^2H(d, d)^2H$, 8:13299 (RA:SU:In Russian)
Fast-neutron elastic-scattering cross sections of elemental tin, 8:13320 (R:US)
Fast-neutron total and scattering cross sections of ^{103}Rh, 8:13319 (R:US)
Fission
Analysis of the average ^{235}U, ^{238}U and ^{239}Pu fission cross sections on ^{238}U and ^{252}Cf fission neutron spectra, 8:13351 (RA:SU:In Russian)
Fission-fragment angular distributions and total kinetic energies for $^{235}U(n,f)$ from .18 to 8.83 MeV, 8:13348 (R:US)
Inelastic Scattering
^{238}U and ^{232}Th levels excited in the (n, n') reactions with 3 MeV neutrons, 8:13352 (RA:SU:In Russian)
Fast-neutron total and scattering cross sections of ^{103}Rh, 8:13319 (R:US)
Multiplication Factors
Cross-section sensitivity analysis for a tandem mirror hybrid reactor and considerations regarding new ^9Be (n, 2n) cross-section evaluations, 8:13520 (J:US)
Total Cross Sections
Fast-neutron total and scattering cross sections of ^{103}Rh, 8:13319 (R:US)
NEUTRON TRANSPORT
Streaming of 14-MeV neutrons through an iron duct: comparison of measured neutron and gamma-ray energy

spectra with results calculated using the Monte Carlo code MCNP, 8:13492 (R:US)
Computer Calculations
Integral transport multiregion geometrical shadowing factor for the approximate collision probability matrix calculation of infinite closely packed lattices, 8:12347 (D:US)
NEUTRON TRANSPORT THEORY
Raffle V general purpose Monte Carlo code for neutron and gamma transport, 8:12339 (R:US)
A Codes
ANAUSN - a one-dimensional multigroup SN transport theory module for the AUS reactor neutronics system, 8:12337 (R:AU)
NEUTRONS
See also RESONANCE NEUTRONS
Oscillations
Oscillating neutrons and disappearing baryons: a theoretical overview, 8:13275 (R:US)
NEVADA
Geochemical Surveys
Hydrogeochemical and stream-sediment reconnaissance basic data for Fresno and Death Valley quadrangles, California; Nevada. Uranium Resource Evaluation Project, 8:11832 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Uranium Deposits
Hydrogeochemical and stream-sediment reconnaissance basic data for Fresno and Death Valley quadrangles, California; Nevada. Uranium Resource Evaluation Project, 8:11832 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Caliente, Lund, Ely, and Elko Quadrangles, Nevada; Utah, 8:11833 (R:US)
NEVADA TEST SITE
Seismic Surveys
Reconnaissance seismic refraction studies at Calico Hills, Wahmonie, and Yucca Mountain: southwest Nevada Test Site, Nye County, Nevada (Calico Hills, Wahmonie, and Yucca Mountain), 8:13214 (R:US)
Spent Fuel Storage
Experimental and calculational results from the Spent Fuel Test-Climax, 8:11854 (R:US)
NEW HAMPSHIRE
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
NEW JERSEY
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
NEW MEXICO
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
NEW YORK
Energy Policy
Assessment of energy conservation opportunities in state-assisted housing, 8:12478 (R:US)
Perspectives on states' transportation energy conservation plans, 8:12603 (RA:US)
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Peat resource assessment for the State of New York, 8:11711 (RA:US)
Radioactive Waste Facilities
Low-level radioactive waste disposal: commercial facilities no longer operating, 8:11871 (RA:US)
Transportation Sector
Perspectives on states' transportation energy conservation plans, 8:12603 (RA:US)
Perspectives on states' transportation energy conservation plans, 8:12604 (RA:US)
Transportation energy: an overview, with emphasis on New York State, 8:12584 (RA:US)
NEW ZEALAND
Coal Deposits
Coal conversion in New Zealand: the South Island lignite programme, 8:11724 (RA:US)
Coal Liquefaction
Coal conversion in New Zealand: the South Island lignite programme, 8:11724 (RA:US)
Coal Reserves
Coal conversion in New Zealand: the South Island lignite programme, 8:11724 (RA:US)
Energy Supplies
Coal conversion in New Zealand: the South Island lignite programme, 8:11724 (RA:US)
NICARAGUA
Geochemical Surveys
Cerro Prieto geothermal field: exploration during exploitation, 8:12199 (R:US)
Geological Surveys
Cerro Prieto geothermal field: exploration during exploitation, 8:12199 (R:US)
Geophysical Surveys
Cerro Prieto geothermal field: exploration during exploitation, 8:12199 (R:US)
Geothermal Fields
Cerro Prieto geothermal field: exploration during exploitation, 8:12199 (R:US)
NICKEL
Absorption Spectroscopy
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Catalytic Effects
Dehydrogenation processes on nickel and platinum surfaces. Conversion of cyclohexane, cyclohexene, and cyclohexadiene to benzene, 8:12810 (J:US)
Chemical Vapor Deposition
Wafer-scale laser lithography. I. Pyrolytic deposition of metal microstructures (For ultra-large scale integrated circuits), 8:12887 (R:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Laser Spectroscopy
Laser-excited atomic-fluorescence spectrometery as a tool for chemical analysis, 8:12756 (R:US)
Liquid Column Chromatography
Multicomponent separations using a continuous annular chromatograph, 8:12759 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Oxidation
Examination of the growth of NiO on Ni using magnetic-resonance techniques, 8:12666 (R:US)
Protective oxide films. Progress report, 8:12665 (R:US)
Surface Properties
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R:US)
NICKEL 58
Multipole Transitions
Effect the residual force spin components on the properties of the electrical type states in the spherical nuclei, 8:13326 (RA:SU:In Russian)

NICKEL ALLOYS
See also ALLOY-HK-40
ALLOY-RA-333
HAYNES STELLITE 6B
NICKEL BASE ALLOYS
STAINLESS STEEL-21-6-9
Phase Transformations
Effect of stress on the transformation in nickel-titanium, 8:12677 (R:US)
Relaxation Time
Direct spectrum-analysis method for obtaining the relaxation-time spectrum from relaxation-response data: amorphous metals ($Fe_{40}Ni_{40}P_{14}B_6$), 8:12684 (R:US)
Shape Memory Effect
Effect of stress on the transformation in nickel-titanium, 8:12677 (R:US)
NICKEL BASE ALLOYS
See also HAYNES 188 ALLOY
INCONEL 671
Corrosion
Determination of the corrosion rate of Ni-Fe coatings by measuring polarization resistance, 8:12703 (TJ:US)
Hydrogen Embrittlement
Heat treating effects on environmental hydrogen embrittlement of nickel (Nickel 200, Duranickel 301, Ni—2% Be), 8:12669 (R:US)
Microstructure
Use of analytical electron microscopy and auger electron spectroscopy for evaluating materials, 8:12760 (R:US)
Phase Studies
Study of the anomalous behavior of the electrical resistivity in alloys near the $PrNi_5$ composition, 8:12682 (R:US)
NICKEL COMPOUNDS
See also NICKEL SULFIDES
Phagocytosis
Phagocytosis of particulate nickel compounds by rat peritoneal macrophages in vitro, 8:13190 (J:US)
NICKEL SULFIDES
Biological Effects
Induction of ocular neoplasms in Fischer rats by intraocular injection of nickel subsulfide, 8:13185 (J:US)
NICKEL-IRON BATTERIES
See IRON-NICKEL BATTERIES
NIOBATES
Specific compounds should be indexed by coordination of a descriptor in the form (CATION) COMPOUNDS and the above anion descriptor.
Electrical Properties
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
Grain Orientation
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
NIOBIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Fracture Properties
X-ray topographic fractography of single crystals of molybdenum and niobium, 8:12667 (R:US)
Magnetization
Superconductivity and magnetism in metallic superlattices, 8:12700 (J:CH)
Superconductivity
Superconductivity and magnetism in metallic superlattices, 8:12700 (J:CH)
NIOBIUM ALLOYS
See also INCONEL 600
NIOBIUM BASE ALLOYS
Atom Transport
Hydrogen and deuterium diffusion in vanadium alloys (Containing Ti or Nb), 8:12676 (R:US)
Physical Radiation Effects
Effect of neutron irradiation on the critical temperature of Nb_3Ge, 8:12735 (RA:CS:In Czech)
Stability
Stability of NbTi composite superconductors of high CU/SC-ratio, 8:12848 (R:DE:In English)
Transition Temperature
Effect of neutron irradiation on the critical temperature of Nb_3Ge, 8:12735 (RA:CS:In Czech)
NIOBIUM BASE ALLOYS
Fabrication
Materials research for hydrogen-cooled superconducting power-transmission lines (SPTL). Part I. Liquid hydrogen as a dielectric. Part II. Superconducting materials. Annual report, January 1, 1981-December 31, 1981 (Nb_3Ge), 8:12668 (R:US)
Young Modulus
Effects of ternary additions on Young's modulus and the martensitic transformation of Nb_3Sn (Effects of Ta, Ti, Zr), 8:12659 (R:US)
NIOBIUM COMPOUNDS
See also NIOBATES
NIOBIUM NITRIDES
Crystal Structure
Neutron and X-ray diffraction on Nb_3Ge, 8:12780 (RA:DK:In Danish)
NIOBIUM NITRIDES
Electronic Structure
Electron-energy-loss and ultraviolet-photoemission study of VN/sub x/, NbN/sub x/, and ZrN/sub x/, 8:12711 (R:US)
NITRIC ACID
Distillation
Pt. 3. Acid separation, 8:11886 (RA:XE:In German)
Recycling
Pt. 3. Acid separation, 8:11886 (RA:XE:In German)
NITRIC OXIDE
NO.
Complexometry
Kintic study of ferrous nitrosyl complexes, 8:12800 (J:US)
Dissociation
Kintic study of ferrous nitrosyl complexes, 8:12800 (J:US)
Molecular Beams
Molecular-beam photoionization studies of molecules and their van der Waals clusters, 8:12815 (R:US)
NITRO COMPOUNDS
Mutagen Screening
Screening of mutagens by inhibition of DNA synthesis, 8:13191 (BA:US)
NITROCELLULOSE
Energy Dependence
Hadron personnel monitoring around high-energy proton accelerators, 8:12981 (RA:US)
Sensitivity
Hadron personnel monitoring around high-energy proton accelerators, 8:12981 (RA:US)
NITROGEN
Bioassay
Applications of nuclear technologies for in-vivo elemental analysis, 8:13059 (R:US)
Photoemission
Partial cross sections and density of states effects in the valence band photoemission from solid nitrogen, 8:12732 (R:DE)
NITROGEN 13
Beam Production
Radioactive ions beams for studying astrophysical nuclear reactions, 8:12909 (R:US)
NITROGEN 14
Energy Levels
Charge-exchange 1^+ excitations and precritical phenomena in the atomic nuclei, 8:13304 (RA:SU:In Russian)
Giant Resonance
Charge-exchange 1^+ excitations and precritical phenomena in the atomic nuclei, 8:13304 (RA:SU:In Russian)

NITROGEN 14 REACTIONS
Elastic Scattering
Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R:US)
NITROGEN 14 TARGET
Beryllium 9 Reactions
Nuclear physics research. Progress report, April 1, 1982-March 31, 1983, 8:13302 (R:US)
NITROGEN 15 REACTIONS
Elastic Scattering
Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R:US)
NITROGEN DIOXIDE
NO_2.
Monitoring
Resumption of exploratory drilling operations by Texaco, Inc.: state oil and gas lesses - PRC 2725.1 (Jade Prospect), PRC 2206.1 (Anita Prospect), PRC 2955.1 (Refugio Prospect), Santa Barbara County. Final environmental impact report, 8:13101 (R:US)
NITROGEN IONS
Electron Beam Ion Sources
Investigation of ionization efficiency in the "Krion-1" electron-beam source, 8:12923 (R:SU:In Russian)
NITROGEN NITRIDES
See NITROGEN
NITROGEN OXIDES
See also NITRIC OXIDE
NITROGEN DIOXIDE
Air Pollution Abatement
Plasma-jet ignition in a lean-burn CFR engine, 8:12645 (R:US)
Atmospheric Chemistry
Acid deposition in Texas: technical summary and perspective. Final report, 8:13033 (R:US)
Plan to evaluate acid-deposition issues in the state of Texas. Final report, 8:13032 (R:US)
Emission
Evaluation of combustion and cleanup of SRC-II coal-derived liquid fuel, 8:11679 (R:US)
NITRONIC 40
See STAINLESS STEEL-21-6-9
NO. 2 FUEL OIL
See HEATING OILS
NOBLE GASES
See RARE GASES
NOISE POLLUTION
Mathematical Models
Predictions of low-frequency sound from the MOD-1 wind turbine, 8:12260 (R:US)
NOISE (REACTOR)
See REACTOR NOISE
NONAXIAL NUCLEI
See DEFORMED NUCLEI
NONDESTRUCTIVE ANALYSIS
See also ION MICROPROBE ANALYSIS
Basic statistics for nuclear electronics, 8:12949 (R:XE:In Italian)
NONDESTRUCTIVE TESTING
Research Programs
NDE programs at the Ames Laboratory and Iowa State University, 8:12880 (R:US)
Technology Transfer
NDE programs at the Ames Laboratory and Iowa State University, 8:12880 (R:US)
NONLINEAR PROBLEMS
Numerical Solution
On a class of high resolution total-variation-stable finite-difference schemes, 8:13413 (R:US)
NONLINEAR SYSTEMS
See NONLINEAR PROBLEMS
NONRADIOACTIVE WASTE DISPOSAL
See WASTE DISPOSAL
NONRADIOACTIVE WASTES
See GASEOUS WASTES
LIQUID WASTES
SOLID WASTES
WASTES
NORTH CAROLINA
Geological Surveys
State resource estimation: North Carolina, 8:11697 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Peat resources of North Carolina, 8:11712 (RA:US)
State resource estimation: North Carolina, 8:11697 (RA:US)
Radiometric Surveys
Evaluation of uranium geochemical anomalies in the Charlotte 1° x 2° NTMS quadrangle, 8:11829 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
Uranium Deposits
Evaluation of uranium geochemical anomalies in the Charlotte 1° x 2° NTMS quadrangle, 8:11829 (R:US)
NORTH DAKOTA
Geothermal Gradients
Evaluation of hydrothermal resources of North Dakota. Phase III final technical report, 8:12198 (R:US)
Geothermal Resources
Evaluation of hydrothermal resources of North Dakota. Phase III final technical report, 8:12198 (R:US)
Heat Flow
Evaluation of hydrothermal resources of North Dakota. Phase III final technical report, 8:12198 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
NORTHERN IRELAND
See UNITED KINGDOM
NOS. 4, 5, AND 6 FUEL OILS
See RESIDUAL FUELS
NOS. 5 AND 6 BURNER OILS
See RESIDUAL FUELS
NRTS
See IDAHO NATIONAL ENGINEERING LABORATORY
NSLS
Accelerator Facilities
General-purpose stepping motor-encoder positioning subsystem with standard asynchronous serial-line interface, 8:12911 (R:US)
Computerized Control Systems
Experiment control and data-acquisition system for the biology small-angle x-ray-scattering station, 8:12939 (R:US)
General-purpose stepping motor-encoder positioning subsystem with standard asynchronous serial-line interface, 8:12911 (R:US)
Data Acquisition Systems
Experiment control and data-acquisition system for the biology small-angle x-ray-scattering station, 8:12939 (R:US)
Free Electron Lasers
Brookhaven free-electron laser experiment, 8:12937 (R:US)
Operation
Research using synchrotron radiation at the National Synchrotron Light Source, 8:12910 (R:US)
Vacuum Systems
Final design and status of the NSLS vacuum system, 8:12938 (R:US)
NUCLEAR ACCIDENTS
See ACCIDENTS
NUCLEAR ATTACKS
See NUCLEAR WEAPONS
NUCLEAR CHEMISTRY
Data Acquisition Systems
DDCMP protocol on a DMA serial-line board, 8:13008 (R:US)
Research Programs
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
NUCLEAR CONTROVERSY
See HUMAN POPULATIONS

NUCLEAR CORES
Moment of Inertia
Determination of the core inertial characteristics according to the data on the aligned angular moment of the octupole bands, 8:13357 (RA:SU:In Russian)
NUCLEAR DATA COLLECTIONS
ENDF/B fission-product data, 8:13321 (R:US)
Indexes
Index of nuclear data libraries available from the IAEA Nuclear Data Section, 8:13571 (R:XA)
Proton Reactions
PNESD proton nucleus elastic scattering data. Contents and documentation, 8:13296 (R:XA)
NUCLEAR DEFORMATION
For deformation of not permanently deformed nuclei.
Potential Energy
Nuclear-deformation energies according to a liquid-drop model with a sharp surface, 8:13335 (R:US)
NUCLEAR ENERGY
Energy Policy
United States Department of Energy: a history, 8:12487 (R:US)
NUCLEAR EXPLOSION DETECTION
Seismic Detection
Regional seismic test network, 8:13017 (RA:US)
NUCLEAR EXPLOSIONS
Specifically named single nuclear explosions are listed by name and the word EVENT, e.g., BOXCAR EVENT. All projects involving nuclear explosions are listed by the project name and the word PROJECT, e.g., PLOWSHARE PROJECT.
Data Acquisition Systems
Timing and control monitor system requirements: an overview, 8:13015 (R:US)
Monitoring
Timing and control monitor system requirements: an overview, 8:13015 (R:US)
Radiation Hazards
Review of dosimetry for the atomic bomb survivors, 8:13158 (J:US)
NUCLEAR FACILITIES
See also FEED MATERIALS PLANTS
FUEL FABRICATION PLANTS
FUEL REPROCESSING PLANTS
ISOTOPE SEPARATION PLANTS
NUCLEAR POWER PLANTS
RADIOACTIVE WASTE FACILITIES
Accounting
International safeguards data-management system, 8:11935 (R:XE)
Emergency Plans
Accident analysis and DOE criteria, 8:11927 (R:US)
Legal Aspects
Summary information report, 8:12330 (R:US)
Title list of documents made publicly available, August 1-31, 1982, 8:12328 (R:US)
Licensing
Summary information report, 8:12330 (R:US)
Safety Standards
Proposed statement on safety objectives for nuclear activities in Canada, 8:12327 (R:CA)
NUCLEAR FORCES
Boson-Exchange Models
Relativistic effects in a nucleus and nuclear forces and models, 8:13360 (RA:SU:In Russian)
Gluon Model
Meson theory of the nuclear forces, 8:13359 (RA:SU:In Russian)
P Invariance
Parity-nonconserving nuclear forces, 8:13355 (R:US)
NUCLEAR FUEL ELEMENTS
See FUEL ELEMENTS
NUCLEAR FUELS
See also SPENT FUELS
Environmental Impacts
Environmental impacts of energy utilization, 8:12468 (R:BR:In Portuguese)
NUCLEAR INDUSTRY
Economics
International nuclear-model prototype: program descripttion, 8:12333 (R:US)
Fuel Cycle
Comparing the health and environmental hazards of different energy systems, 8:13100 (R:US)
Enrichment, demand, planning, facility deployment, and pricing, 8:11932 (R:US)
Manpower
Forecasts of on-site and off-site occupational requirements for energy-construction developments in the United States, 1982 to 2000, 8:12465 (R:US)
Manpower problems in an unsettled nuclear industry, 8:12369 (J:US)
NUCLEAR MATERIALS MANAGEMENT
Accounting
International safeguards data management system, 8:11934 (R:XE)
International safeguards data-management system, 8:11935 (R:XE)
Loss detection and alarm resolution in processing special nuclear material, 8:11941 (R:US)
Nondestructive Analysis
Selected measurement data for plutonium and uranium, 8:11940 (R:US)
NUCLEAR MATTER
Collective Excitations
Collective excitations of nuclear matter in the adiabatic time-dependent Hartree-Fock theory, 8:13361 (RA:SU:In Russian)
Oscillations
Collective excitations of nuclear matter in the adiabatic time-dependent Hartree-Fock theory, 8:13361 (RA:SU:In Russian)
Phase Transformations
Research in theoretical physics. Annual progress report, April 1, 1982-March 31, 1983, 8:13286 (R:US)
NUCLEAR MEDICINE
Meetings
Proceedings of the 1977 joint annual convention, Radioisotope Society of the Phillippines Inc., and the Philippine Society for Nuclear Medicine, 8:11945 (R:PH)
Research Programs
Nuclear medicine progress report for quarter ending September 30, 1982, 8:13131 (R:US)
NUCLEAR PHYSICS
Use only for indexing articles of very broad coverage, such as annual reviews, text books, etc.
Research Programs
Annual report, 1981. Cosmic and subatomic physics, elementary particle physics, mathematical physics, and theoretical high energy physics, 8:13226 (R:SE)
Experimental and theoretical nuclear physics. Final report, 8:13292 (R:US)
Physics Division annual review, 1 April 1980-31 March 1981, 8:13293 (R:US)
Progress report, September 1, 1981-August 31, 1982, 8:13294 (R:US)
Report of activity, 8:12471 (R:FR:FR)
NUCLEAR POWER
Global Aspects
Worldwide nuclear power, 8:12476 (J:US)
Health Hazards
Occupational risk from nuclear power, 8:11931 (J:US)
NUCLEAR POWER PLANTS
See also OFFSHORE NUCLEAR POWER PLANTS
Containment Buildings
Buckling investigation of ring-stiffened cylindrical shells under unsymmetrical axial loads, 8:12352 (R:US)
Control Rooms
Control and instrumentation, 8:12363 (J:US)
Economics
International nuclear-model prototype: program descripttion, 8:12333 (R:US)
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Electric Cables
Nuclear power plant electrical cable damageability experiments, 8:12351 (R:US)

Financing
Bonneville Power Administration and Rural Electrification Administration actions and activities affecting utility participation in Washington Public Power Supply System Plants 4 and 5, 8:12506 (R:US)
Global Aspects
Comparison of Ontario Hydro's performance with world power reactors, 1981, 8:12475 (R:CA)
Inspection
Methodology for the inspection of items important to safety. The Canadian approach, 8:12399 (R:CA)
Legal Aspects
Unresolved safety issues summary: aqua book, 8:12405 (R:US)
Loss of Coolant
UW-4F: a mechanistic four-fluid two-phase flow model for LOCA analysis during reflood, 8:12442 (D:US)
Occupational Safety
Allowable shipment frequencies for the transport of toxic gases near nuclear power plants, 8:13184 (R:US)
Planning
Bonneville Power Administration and Rural Electrification Administration actions and activities affecting utility participation in Washington Public Power Supply System Plants 4 and 5, 8:12506 (R:US)
Pressure Vessels
Survey of defects in pressure vessels in the UK for the period 1962-1978 and its relevance to nuclear primary circuits, 8:12354 (R:GB)
Radiation Monitoring
NRC TLD direct radiation monitoring network. Progress report, April-June 1982, 8:12367 (R:US)
Radioactive Effluents
NRC TLD direct radiation monitoring network. Progress report, April-June 1982, 8:12367 (R:US)
Radioactive effluents from nuclear power stations in the European Community, 1974-1978, 8:12368 (J:US)
Reactor Components
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)
Reactor Decommissioning
Funding nuclear-power-plant decommissioning. Final report, 8:12336 (R:US)
Reactor Licensing
Licensing procedure for construction and operation of nuclear power plants, 8:12324 (R:BR:In Portuguese)
Licensing and safety of nuclear power plants in Canada, 8:12325 (R:CA)
Status of power-reactor projects undergoing licensing review, 8:12332 (J:US)
Reactor Operation
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)
Operating US power reactors, 8:12297 (J:US)
Power reactor events, 8:12409 (R:US)
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Reactor Safety
Development and application of a methodology for the analysis of significant human related event trends in nuclear power plants, 8:12441 (D:US)
Selected review of foreign safety research for nuclear power plants, 8:12417 (R:US)
Unresolved safety issues summary: aqua book, 8:12405 (R:US)
Validation of real-time software for nuclear-plant-safety applications. Final report, 8:12391 (R:US)
Safety Standards
Recommendations on AECB draft licensing guides nos. 40, 41, 42, 8:12326 (R:CA)

NUCLEAR POWER STATIONS
See NUCLEAR POWER PLANTS

NUCLEAR SAFETY
See RADIATION PROTECTION

NUCLEAR SHIP OTTO HAHN REACTOR
See OTTO HAHN REACTOR

NUCLEAR STRUCTURE
Collective Excitations
Effect of zero collective oscillations on observed nuclear properties, 8:13366 (RA:SU:In Russian)
Research Programs
Nuclear-structure studies using the high-resolution spectrometer at the Los Alamos Clinton P. Anderson Meson Physics Facility. Progress report, 8:13295 (R:US)

NUCLEAR WASTES
See RADIOACTIVE WASTES

NUCLEAR WEAPON TESTS
See NUCLEAR EXPLOSIONS

NUCLEAR WEAPONS
Compatibility
Automated core-test experiment, 8:13016 (R:US)

NUCLEI
See also DEFORMED NUCLEI
EVEN-EVEN NUCLEI
HEAVY NUCLEI
HYPERNUCLEI
INTERMEDIATE MASS NUCLEI
LIGHT NUCLEI
Energy-Level Transitions
Gamma rays from the interactions of reactor fast neutrons ordered by increasing gamma-ray energy, 8:13334 (R:US)
Gamma Spectra
Gamma rays from the interactions of reactor fast neutrons ordered by increasing gamma-ray energy, 8:13334 (R:US)
Potential Energy
Nuclear-deformation energies according to a liquid-drop model with a sharp surface, 8:13335 (R:US)
Rotational States
Description of rotation using of collective bosons with Ksup(π)=Isup(+) momentum projection, 8:13369 (RA:SU:In Russian)

NUCLEON-ANTINUCLEON INTERACTIONS
See also ANTIPROTON-NEUTRON INTERACTIONS
PROTON-ANTIPROTON INTERACTIONS
Pair Production
Dimuon production in hadronic interactions, 8:13258 (R:US)
Particle Production
Dimuon production in hadronic interactions, 8:13258 (R:US)

NUCLEON-NUCLEON POTENTIAL
P Invariance
Parity-nonconserving nuclear forces, 8:13355 (R:US)

NUCLEOSOMES
Mathematical Models
Neutron scattering studies and modeling of high mobility group 14 core nucleosome complex, 8:13105 (J:US)
Molecular Structure
Neutron scattering studies and modeling of high mobility group 14 core nucleosome complex, 8:13105 (J:US)

NUMERICAL ANALYSIS
Computer Codes
UFO (UnFold Operator) computer program abstract, 8:13562 (R:US)

O

OAK RIDGE GASEOUS DIFFUSION PLANT
See ORGDP

OAK RIDGE NATIONAL LABORATORY
See ORNL

OBRIGHEIM REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)

OCCLUSION COMPLEXES
See CLATHRATES

OCCUPATIONAL SAFETY
Quality Assurance
Approach to E, S, and H assurance programs for institutions. Volume II. Line-organization functions, 8:12469 (R:US)

OCEAN THERMAL POWER PLANTS
Gas Compressors
Study of hydraulic air compression for Ocean Thermal Energy Conversion open-cycle application, 8:12132 (R:US)
Hybrid Systems
Ocean thermal energy at the Johns Hopkins University Applied Physics Laboratory, quarterly report. Report for Jan-Mar 82, 8:12133 (R:US)
Legal Aspects
Ocean thermal energy at the Johns Hopkins University Applied Physics Laboratory, quarterly report. Report for Jan-Mar 82, 8:12133 (R:US)
OCTANE NUMBER
See ANTIKNOCK RATINGS
OFF-GAS SYSTEMS
Performance Testing
Efficient particulate scrubber for glass melter off-gas, 8:11880 (R:US)
OFFICE BUILDINGS
Design
Designing for energy efficiency: a study of eight California state office buildings, 8:12560 (R:US)
Energy Conservation
A methodology for determining building heating system changeover timing. Master's thesis, 8:12552 (R:US)
Energy Efficiency
Designing for energy efficiency: a study of eight California state office buildings, 8:12560 (R:US)
Photovoltaic Power Supplies
Initial detailed designs for intermediate photovoltaic systems: office building, 8:12118 (R:US)
Temperature Distribution
A methodology for determining building heating system changeover timing. Master's thesis, 8:12552 (R:US)
OFFSHORE NUCLEAR POWER PLANTS
Containment Shells
Buckling of steel containment shells. Task 1a. Dynamic response and buckling of offshore power systems' floating nuclear plant containment vessel. Final report, 25 August 1980-30 September 1982, 8:12350 (R:US)
OHIO
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
OHIO VALLEY REGION
Coal Mining
Ohio River Basin energy study: health aspects, 8:12284 (R:US)
Power Transmission
Ohio River Basin energy study: health aspects, 8:12284 (R:US)
Thermal Power Plants
Ohio River Basin energy study: health aspects, 8:12284 (R:US)
Uranium Mines
Ohio River Basin energy study: health aspects, 8:12284 (R:US)
OIL FIELDS
Reservoir Engineering
North Tisdale Mine: gravity drainage project, 8:11795 (RA:US)
Tunneling
North Tisdale Mine: gravity drainage project, 8:11795 (RA:US)
OIL SATURATION
Measuring Methods
Development of a rapid and accurate method for determining partition coefficients of chemical tracers between oils and brines (for single well tracer tests). Final report, 8:11796 (R:US)
OIL SHALE INDUSTRY
Commercialization
Application of the Toscoal process to the electric utility industry, 8:12269 (RA:US)
OIL SHALE WASTE WATER
See OIL SHALES WASTE WATER
OIL SHALES
See also BLACK SHALES
Production
Low-rank coal exploitation and utilization in east European countries (USSR; 1950 to 1979), 8:11734 (RA:US)
OIL WELLS
Acidization
Correlation of petroleum component properties for caustic flooding, 8:12772 (J:US)
Caustic Flooding
Correlation of petroleum component properties for caustic flooding, 8:12772 (J:US)
Oil banking phenomena in surfactant/polymer and caustic flooding: droplet coalescence and entrapment processes, 8:11805 (J:US)
Environmental Impact Statements
Resumption of exploratory drilling operations by Texaco, Inc.: state oil and gas lesses - PRC 2725.1 (Jade Prospect), PRC 2206.1 (Anita Prospect), PRC 2955.1 (Refugio Prospect), Santa Barbara County. Final environmental impact report, 8:13101 (R:US)
Microemulsion Flooding
Fluid microstructures and enhanced oil recovery, 8:11800 (J:US)
Interfacial phenomena in enhanced oil recovery, 8:11799 (B:US)
Liquid crystals and microemulsions in oil recovery, 8:11801 (J:US)
Magnitude and role of dynamic interfacial effects in low tension flooding, 8:11806 (J:US)
Oil banking phenomena in surfactant/polymer and caustic flooding: droplet coalescence and entrapment processes, 8:11805 (J:US)
Ultra-low IFT, phase behavior and microstructure in oil/brine/surfactant/alcohol systems, 8:11802 (J:US)
Miscible-Phase Displacement
Enhanced oil recovery: environmental issues and state regulatory programs, 8:13063 (J:GB)
Reservoir Engineering
Well-loss function and the skin effect: a review, 8:11798 (J:US)
Steam Injection
Light oil steamflooding: an emerging technology, 8:11793 (RA:US)
Testing
Instrumentation for well tests, 8:12251 (J:US)
Waterflooding
Enhanced oil recovery: environmental issues and state regulatory programs, 8:13063 (J:GB)
Interfacial effects upon displacement in sinusoidal capillaries, 8:11803 (J:US)
Investigation of the inaccessible pore volume phenomena, 8:11804 (J:US)
Well Drilling
North Tisdale Mine: gravity drainage project, 8:11795 (RA:US)
Wind Turbines
Use of wind power to assist in stripper (oil) well pumping, 8:12265 (R:US)
OILS
See also COTTONSEED OIL
FUEL OILS
International outlook of Otto versus diesel cycle engine for operation on biomass fuels, 8:12652 (RA:BR)
Chemical Composition
Use vegetable oils in internal combustion engines, 8:12040 (RA:BR)
Chemical Properties
Use vegetable oils in internal combustion engines, 8:12040 (RA:BR)
Physical Properties
Use vegetable oils in internal combustion engines, 8:12040 (RA:BR)
OKLAHOMA
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)

Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)

OLEFINS
See ALKENES

ON-LINE COMPUTERS
See COMPUTERS

ON-LINE MEASUREMENT SYSTEMS
Design
Fast breeder reactor on-line monitoring and diagnosis strategy development via Dynamic Data System (DDS) methodology, 8:12364 (D:US)

ONTARIO
Energy Policy
Notes for an address on coal, 8:11787 (R:CA)
Energy Supplies
Notes for an address on coal, 8:11787 (R:CA)
Government Policies
Notes for an address on coal, 8:11787 (R:CA)

OPTICAL SYSTEMS
Fabrication
Laser-interferometer position-feedback for precision machine tools, 8:13499 (R:US)

OPTICS
Seven technologies for the eighties, 8:12470 (R:US)

OREGON
Geochemical Surveys
Hydrogeochemical and stream-sediment reconnaissance basic data for Adel, Jordan Valley, and Twin Falls quadrangles, Oregon; Idaho. Uranium Resource Evaluation Project, 8:11834 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Uranium Deposits
Hydrogeochemical and stream-sediment reconnaissance basic data for Adel, Jordan Valley, and Twin Falls quadrangles, Oregon; Idaho. Uranium Resource Evaluation Project, 8:11834 (R:US)

ORGANIC CHLORINE COMPOUNDS
See also CHLORINATED ALICYCLIC HYDROCARBONS
CHLORINATED AROMATIC HYDROCARBONS
Chemical Analysis
Applications of ion chromatography, 8:12747 (R:US)

ORGANIC COMPOUNDS
See also AMINES
AROMATICS
CARBOHYDRATES
HETEROCYCLIC COMPOUNDS
HYDROCARBONS
ORGANIC POLYMERS
ORGANIC SULFUR COMPOUNDS
ORGANOMETALLIC COMPOUNDS
PROTEINS
Chemical Radiation Effects
Radiation-induced effects in organic systems. Final report, 8:12819 (R:US)
Chemistry
Organic chemistry and technology of organic substances. Bioorganic chemistry and biochemistry. Chemistry and technology of high-molecular compounds. Vol. 2, 8:12806 (R:SU:RU)
Gas Chromatography
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Mass Spectroscopy
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)

ORGANIC FLUORINE COMPOUNDS
Chemical Preparation
New method using anhydrous [^{18}F]fluoride to radiolabel 2-[^{18}F]fluoro-2-deoxy-D-glucose, 8:12826 (J:US)
Tissue Distribution
New method using anhydrous [^{18}F]fluoride to radiolabel 2-[^{18}F]fluoro-2-deoxy-D-glucose, 8:12826 (J:US)

ORGANIC MATTER
Only for unspecified materials containing chain and ring compounds of carbon; if specific organic compounds are studied, use descriptors for the compounds.
See also PEAT
Mass Spectra
Fundamental pyrolysis studies, 8:12076 (RA:US)

ORGANIC POLYMERS
See also PLASTIC FOAMS
POLYESTERS
POLYETHYLENE GLYCOLS
RUBBERS
Energy Dependence
Personnel neutron dosimeters based on organic polymers, 8:12978 (RA:US)
Phase Studies
Ultra-low IFT, phase behavior and microstructure in oil/brine/surfactant/alcohol systems, 8:11802 (J:US)
Recovery
Investigation of the inaccessible pore volume phenomena, 8:11804 (J:US)

ORGANIC SOLVENTS
Comparative Evaluations
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Final progress report, February 1980-July 1982, 8:11628 (R:US)
Deashing
Heavy recycle-solvent studies in two-stage coal liquefaction. Second technical progress report, October 1-December 10, 1982, 8:11643 (R:US)
Dissolution
Heavy recycle-solvent studies in two-stage coal liquefaction. Second technical progress report, October 1-December 10, 1982, 8:11643 (R:US)
Distillation
Heavy recycle-solvent studies in two-stage coal liquefaction. Second technical progress report, October 1-December 10, 1982, 8:11643 (R:US)
Electron Spin Resonance
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Evaluation
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Final progress report, February 1980-July 1982, 8:11628 (R:US)
Hydrogen Transfer
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No. 3, 8:11631 (R:US)
Integrated two-stage liquefaction. Topical technical progress report completion of Indiana V program, April 1, 1981-September 30, 1981, 8:11618 (R:US)
Isomerization
Investigation of mechanisms of hydrogen transfer in coal hydrogenation. Final progress report, February 1980-July 1982, 8:11628 (R:US)
Liquid Column Chromatography
Heavy recycle-solvent studies in two-stage coal liquefaction. Second technical progress report, October 1-December 10, 1982, 8:11643 (R:US)
Mixing
Coal slurry mixing: residence time and temperature effects on SRC feed slurries, 8:11655 (R:US)
Performance Testing
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No. 3, 8:11631 (R:US)
Recycling
Heavy recycle-solvent studies in two-stage coal liquefaction. Second technical progress report, October 1-December 10, 1982, 8:11643 (R:US)

ORGANIC SULFUR COMPOUNDS
See also SULFONATES
SULFONIC ACIDS
THIONAPHTHENES

Chemical Analysis
Direct determination of organic sulfur in coal by electron-beam microanalysis, 8:11677 (R:US)
Electron Microprobe Analysis
Direct determination of organic sulfur in coal by electron-beam microanalysis, 8:11677 (R:US)
Scanning Electron Microscopy
Direct determination of organic sulfur in coal by electron-beam microanalysis, 8:11677 (R:US)

ORGANOMETALLIC COMPOUNDS
For compounds of metals and semimetals with organic compounds, but only when the metal or semimetal is directly bound to carbon.
Chemical Analysis
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Chemical Reaction Kinetics
Kinetics and mechanisms of the reactions of aliphatic free radicals with organocobaloximes and fluoropentaamminecobalt(III) ion, and of iron(III) with methylrhodoxime, 8:12789 (R:US)
Decomposition
Kinetic and mechanistic studies of the reactions of selected aliphatic radicals with metal complexes and the decomposition of organoperoxy cobalt complexes, 8:12788 (R:US)
Kinetic studies of organocobalt compounds related to vitamin B_{12} coenzymes, 8:12786 (R:US)

ORGANS
See also LUNGS
SKELETON
SKIN
Radionuclide Kinetics
1976 Hanford americium exposure incident: organ burden and radiation dose estimates, 8:13148 (R:US)

ORGDP
Environmental Impacts
Environmental assessment of the Oak Ridge Gaseous Diffusion Plant site, 8:11921 (R:US)
Health Hazards
Environmental assessment of the Oak Ridge Gaseous Diffusion Plant site, 8:11921 (R:US)
Socio-Economic Factors
Environmental assessment of the Oak Ridge Gaseous Diffusion Plant site, 8:11921 (R:US)

ORNL
Radioactivity
Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R:US)

ORNL ISOCHRONOUS CYCLOTRON
Computerized Control Systems
Database automation of accelerator operation, 8:12930 (R:US)

OSCILLATIONS (PLASMA)
See PLASMA WAVES

OSMIUM COMPLEXES
Crystal Structure
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)
Infrared Spectra
Isotope effects in the infrared spectra of the metal carbonyl hydride/deuteride anions $(H/D)M(CO)_4p$ (M = Fe, Ru, or Os), 8:12798 (J:US)
Molecular Structure
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)
Synthesis
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)

OTTO CYCLE
Fuel Substitution
International outlook of Otto versus diesel cycle engine for operation on biomass fuels, 8:12652 (RA:BR)

OTTO HAHN REACTOR
Decontamination
Determination of the contamination and decontamination of the fuel basin of the nuclear-powered ship Otto Hahn, 8:12382 (R:CH:GE)

OUTAGES
Research Programs
Ensuring power-system stability, 8:12286 (J:US)

OVERBURDEN
Drill Cores
Overburden characterization and post-burn study of the Hoe Creek, Wyoming underground coal gasification site and comparison with the Hanna, Wyoming site, 8:11622 (R:US)

OVERTHRUST BELT
See WESTERN US OVERTHRUST BELT

OXIDES
See also ALUMINIUM OXIDES
CALCIUM OXIDES
COPPER OXIDES
EUROPIUM OXIDES
INDIUM OXIDES
IRON OXIDES
LITHIUM OXIDES
MAGNESIUM OXIDES
NITROGEN OXIDES
PLUTONIUM OXIDES
SILICON OXIDES
TIN OXIDES
TITANIUM OXIDES
ZINC OXIDES
ZIRCONIUM OXIDES
Structural Chemical Analysis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
Synthesis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)

OXIMES
Chemical Reaction Kinetics
Kinetics and mechanisms of the reactions of aliphatic free radicals with organocobaloximes and fluoropentaamminecobalt(III) ion, and of iron(III) with methylrhodoxime, 8:12789 (R:US)
Decomposition
Kinetic studies of organocobalt compounds related to vitamin B_{12} coenzymes, 8:12786 (R:US)

OXYGEN 15
Radiopharmaceuticals
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)
Tissue Distribution
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)

OXYGEN 16
Giant Resonance
Spectroscopic factors of α-decay of giant isoscalar resonances, 8:13305 (RA:SU:In Russian)
Nuclear Radii
Surface waves in α-nuclei elastic scattering, 8:13303 (R:IT)

OXYGEN 16 REACTIONS
Elastic Scattering
Relativity, nuclear polarizability, and screening in sub-Coulomb elastic scattering, 8:13344 (R:US)
Inelastic Scattering
Three-particle decay of the 14^+ resonance with 19.7 MeV energy excited in the $^{16}O + ^{12}C$ reaction, 8:13309 (RA:SU:In Russian)

OXYGEN 16 TARGET
Alpha Reactions
Surface waves in α-nuclei elastic scattering, 8:13303 (R:IT)
Lithium 7 Reactions
Nuclear physics research. Progress report, April 1, 1982-March 31, 1983, 8:13302 (R:US)

OXYGEN 17 TARGET
Electron Reactions
Covariant description of magnetic and electric properties of extended nuclei with half-integral spin in electronscattering, 8:13310 (RA:SU:In Russian)

OXYGEN 18 TARGET
Proton Reactions
Neutron yields from the 4-12 MeV proton bombardment of ^{11}B, ^{13}C and $^{18}0$ as related to the production of ^{11}C, ^{13}N and ^{18}f, 8:13314 (J:GB)
OXYGEN ENRICHMENT
Energy Consumption
Methods of reducing energy consumption of the oxidant-supply system for MHD/steam power plants, 8:12516 (R:US)
OXYGEN HYDRIDES
See WATER
OXYGEN METERS
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
OYSTER CREEK-1 REACTOR
Environmental Effects
Ecological studies of wood-boring bivalves in the vicinity of the Oyster Creek Nuclear Generating Station. Progress report, March-May 1982, 8:13175 (R:US)
OZONE
Aerial Monitoring
Comparison of ozone in polluted and clean air masses over Lake Michigan, 8:13036 (BA:US)
Flux Density
On the mechanisms that control vertical ozone flux to vegetative surfaces, 8:13035 (BA:US)
Monitoring
Resumption of exploratory drilling operations by Texaco, Inc.: state oil and gas lesses - PRC 2725.1 (Jade Prospect), PRC 2206.1 (Anita Prospect), PRC 2955.1 (Refugio Prospect), Santa Barbara County. Final environmental impact report, 8:13101 (R:US)

P

PACIFIC NORTHWEST LABORATORIES
See BATTELLE PACIFIC NORTHWEST LABORATORIES
PACIFIC NORTHWEST REGION
See FEDERAL REGION X
PACKAGING
Bibliographies
Annotated bibliography for the design of waste packages for geologic disposal of spent fuel and high-level waste, 8:11895 (R:US)
Impact Tests
Analysis and model testing of a Super Tiger Type B Waste transport system in accident environments, 8:12863 (J:US)
PAH
See POLYCYCLIC AROMATIC HYDROCARBONS
PAINTS
Optical Properties
Optimization of solar-selective paint coatings. Final report, September 15, 1980-June 15, 1982, 8:12176 (R:US)
Optimization
Optimization of solar-selective paint coatings. Final report, September 15, 1980-June 15, 1982, 8:12176 (R:US)
Surface Coating
Optimization of solar-selective paint coatings. Final report, September 15, 1980-June 15, 1982, 8:12176 (R:US)
PALISADES-1 REACTOR
Reactor Licensing
Intergrated plant safety assessment. Systematic evaluation program. Palisades plant, Consumers Power Company, Docket No. 50-255. Final report, 8:12407 (R:US)
Reactor Safety
Intergrated plant safety assessment. Systematic evaluation program. Palisades plant, Consumers Power Company, Docket No. 50-255. Final report, 8:12407 (R:US)
Risk Assessment
Intergrated plant safety assessment. Systematic evaluation program. Palisades plant, Consumers Power Company, Docket No. 50-255. Final report, 8:12407 (R:US)
PANTEX PLANT
Environmental Impacts
Supplementary documentation for an environmental impact statement regarding the Pantex Plant: hydrologic study for the Iowa Army Ammunition Plant, 8:13074 (R:US)
Hydrology
Supplementary documentation for an environmental impact statement regarding the Pantex Plant: hydrologic study for the Iowa Army Ammunition Plant, 8:13074 (R:US)
PARABOLIC DISH COLLECTORS
Technology Assessment
Survey of manufacturers of solar-thermal-energy systems, 8:12179 (R:US)
PARABOLIC POINT COLLECTORS
See PARABOLIC DISH COLLECTORS
PARABOLIC TROUGH COLLECTORS
Solar Tracking Systems
Development of a solar-flux tracker for parabolic-trough collectors, 8:12180 (R:US)
Technology Assessment
Survey of manufacturers of solar-thermal-energy systems, 8:12179 (R:US)
PARACHUTES
Drag
Experimental and theoretical investigation of the reduction in parachute drag caused by forebody wake effects: data compilation and program summary, 8:12871 (R:US)
PARAFFINS
See ALKANES
PARTIAL DIFFERENTIAL EQUATIONS
See also POISSON EQUATION
Perturbation method for stochastic operator difference equations, 8:13558 (R:US)
Numerical Solution
Numerical solution of partial differential equations of physics. Pt. 2, 8:13415 (R:DE:In German)
PARTICLE BEAM FUSION ACCELERATOR
Reviews
Sandia technology, 8:13500 (R:US)
PARTICLE BEAMS
Scattering
Scattering of a particle beam by a non-equilibrium plasma, 8:13462 (J:GB)
PARTICLE BOOSTERS
First stages of a multistage accelerator.
On-Line Control Systems
FORTRAN preprocessor in the booster synchrotron control system, 8:12918 (R:SU:In Russian)
PARTICLE INTERACTIONS
See also HADRON-HADRON INTERACTIONS
Particle Models
Theory of high-energy collision processes. Technical progress report, January 1-December 31, 1982, 8:13272 (R:US)
Research Programs
Theory of high-energy collision processes. Technical progress report, January 1-December 31, 1982, 8:13272 (R:US)
PARTICLE SIZE
Bioassay
Laser-based multiparameter system for automatic sorting of microscopic particles, 8:13183 (R:US)
PARTICLE SIZE CLASSIFIERS
Mathematical Models
Fundamental aspects of air classifier operation and design, 8:12631 (R:US)
Performance Testing
Fundamental aspects of air classifier operation and design, 8:12631 (R:US)
PARTICLE TRACKS
Absolute Counting
Evaluation of a commercial, semi-automatic system for counting tracks in solid state nuclear detectors used for personnel dosimetry, 8:12983 (RA:US)
PARTICULATES
Prior to September 1981, this concept was indexed to PARTICLES and AEROSOLS.
See also TOTAL SUSPENDED PARTICULATES

Interaction Range
Long-range interaction of small soot particles (Brief summary), 8:13018 (R:US)
Lung Clearance
Dose to basal cells in bronchial epithelium from long-lived alpha emitters in uranium mines, 8:13171 (BA:US)
Particle Size
Evaluation of combustion and cleanup of SRC-II coal-derived liquid fuel, 8:11679 (R:US)
Radiochemical Analysis
Am-241/Pu-239 + 240 ratios in the marine environment, 8:13094 (J:GB)
Shape
Evaluation of combustion and cleanup of SRC-II coal-derived liquid fuel, 8:11679 (R:US)

PASSIVE SOLAR COOLING SYSTEMS
Design
Passive-solar homes for Texas, 8:12173 (R:US)
Economics
Preliminary economic assessment or residential passive solar cooling potential in the United States, 8:12160 (R:US)

PASSIVE SOLAR HEATING SYSTEMS
See also TROMBE WALLS
Passive-solar heating and cooling demonstration project. Final report, 8:12168 (R:US)
Construction
Dwyer Mercer County District Library. Semi-annual technical progress report, 8:12154 (R:US)
Correlations
Fast correlation method for passive-solar design, 8:12161 (R:US)
Design
Fast correlation method for passive-solar design, 8:12161 (R:US)
Manufactured buildings solar project. Final report, 8:12153 (R:US)
Passive-solar homes for Texas, 8:12173 (R:US)
Performance
First year's performance data of the NCSU Solar Energy and Conservation House, 8:12134 (R:US)

PATIENTS
Radionuclide Kinetics
1976 Hanford americium exposure incident: medical management and chelation therapy, 8:13143 (R:US)

PBFA
See PARTICLE BEAM FUSION ACCELERATOR

PCB
See CHLORINATED AROMATIC HYDROCARBONS

PDU
See PROCESS DEVELOPMENT UNITS

PDX DEVICES
Beam Injection Heating
High-beta experiments with neutral-beam injection on PDX, 8:13449 (R:US)

PEA PLANT
See PISUM

PEANUTS
Chemical Analysis
New analytical techniques for mycotoxins in complex organic matrices, 8:12757 (R:US)

PEAT
Alkaline Hydrolysis
Continued development of a peat biogasification process, 8:11607 (RA:US)
Anaerobic Digestion
Alkaline oxidation of peat (Peat solubilized by alkali), 8:11668 (RA:US)
Continued development of a peat biogasification process, 8:11607 (RA:US)
By-Products
Comprehensive use of peat in the USSR, 8:11727 (RA:US)
Calorific Value
High pressure wet carbonization of peat, 8:11608 (RA:US)
Wet oxidation of peat, 8:11667 (RA:US)
Carbonization
High pressure wet carbonization of peat, 8:11608 (RA:US)
Peat pretreatment: High-pressure wet carbonization, 8:11603 (RA:US)
Centrifugation
Water retention mechanisms in peat, 8:11749 (RA:US)
Chemical Composition
Wet oxidation of peat, 8:11667 (RA:US)
Chemical Reaction Kinetics
Peat conversion and utilization in the United States, 8:11719 (RA:US)
Combustion
Peat research in Finland, 8:11580 (RA:US)
Commercialization
Peat commercialization projects in Maine and Alaska (Peat-Derived Fuel process licensed from JP Energy OY of Helsinki), 8:11782 (RA:US)
Comminution
Peat as a feedstock to the KBW gasification process, 8:11659 (RA:US)
Density
High pressure wet carbonization of peat, 8:11608 (RA:US)
Drying
Peat as a feedstock to the KBW gasification process, 8:11659 (RA:US)
Peat research in Finland, 8:11580 (RA:US)
Peat research and development in Sweden, 8:11750 (RA:US)
Testing of sod peat equipment and elucidation of sod dewatering characteristics, 8:11729 (RA:US)
Economics
Conceptual designs for peat production systems, 8:11728 (RA:US)
Energy Source Development
Socioeconomic issues associated with the use of peat as an energy resource, 8:11689 (RA:US)
Environmental Impacts
Environmental data requirements and analysis for development of peat program, 8:11688 (RA:US)
Exploitation
Socioeconomic issues associated with the use of peat as an energy resource (Initial consideration of environmental and socio-economic factors), 8:11730 (RA:US)
Exploration
Alabama peat resources project, 8:11702 (RA:US)
Alaska peat resource estimate, 8:11703 (RA:US)
Florida peat resource assessment project, 8:11704 (RA:US)
Louisiana peat resources assessment, 8:11706 (RA:US)
Maine peat resource evaluation program, 8:11708 (RA:US)
Overview of state peat resource programs, 8:11701 (RA:US)
Peat research in Finland, 8:11580 (RA:US)
Peat resource estimation in Georgia, 8:11705 (RA:US)
Peat resource definition and utilization in Massachusetts, 8:11707 (RA:US)
Peat resource estimate in Michigan, 8:11709 (RA:US)
Peat resource assessment for the State of New York, 8:11711 (RA:US)
Peat resources of North Carolina, 8:11712 (RA:US)
Peat resource estimation in Rhode Island, 8:11713 (RA:US)
Peat resource estimation in South Carolina, 8:11714 (RA:US)
Peat resource assessment in Wisconsin, 8:11715 (RA:US)
Status of the Minnesota peat inventory project (April, 1982), 8:11710 (RA:US)
Feasibility Studies
Conceptual designs for peat production systems, 8:11728 (RA:US)
Fluidized-Bed Combustion
Fifth technical contractors' conference on peat, 8:11579 (R:US)
Gasification
Comparative analysis of peat gasification reactor configurations, 8:11606 (RA:US)
Hydrogasification of peat, 8:11610 (RA:US)
Methanol from wood and peat, 8:11989 (RA:US)
Peat as a feedstock to the KBW gasification process, 8:11659 (RA:US)
Peat gasification: Rockwell international process, 8:11601 (RA:US)
Peat gasification: low-severity hydropyrolysis, 8:11602 (RA:US)
Peat research in Finland, 8:11580 (RA:US)

Preparation for pilot plant scale peat gasification tests, 8:11605 (RA:US)
Second technical contractors' conference on peat, 8:11600 (R:US)
Single-stage fluidized-bed gasification, 8:11604 (RA:US)
Geological Surveys
Second technical contractors' conference on peat, 8:11600 (R:US)
State resource estimation: Maine, 8:11694 (RA:US)
Harvesting
Peat conversion and utilization in the United States, 8:11719 (RA:US)
Peat research in Finland, 8:11580 (RA:US)
Hydrogenation
Hydrogasification of peat, 8:11610 (RA:US)
Materials Handling
High pressure wet carbonization of peat, 8:11608 (RA:US)
Meetings
Fifth technical contractors' conference on peat, 8:11579 (R:US)
Second technical contractors' conference on peat, 8:11600 (R:US)
Mining
Production of fuel grade peat at First Colony Farms, Inc., 8:11739 (RA:US)
Oxidation
Alkaline oxidation of peat (Peat solubilized by alkali), 8:11668 (RA:US)
Continued development of a peat biogasification process, 8:11607 (RA:US)
Wet oxidation of peat, 8:11667 (RA:US)
Pelletizing
Peat commercialization projects in Maine and Alaska (Peat-Derived Fuel process licensed from JP Energy OY of Helsinki), 8:11782 (RA:US)
Peat research in Finland, 8:11580 (RA:US)
Peat research and development in Sweden, 8:11750 (RA:US)
Production
Comprehensive use of peat in the USSR, 8:11727 (RA:US)
Conceptual designs for peat production systems, 8:11728 (RA:US)
Low-rank coal exploitation and utilization in east European countries (USSR; 1950 to 1979), 8:11734 (RA:US)
Pyrolysis
Peat gasification: low-severity hydropyrolysis, 8:11602 (RA:US)
Research Programs
Fifth technical contractors' conference on peat, 8:11579 (R:US)
Peat conversion and utilization in the United States, 8:11719 (RA:US)
Peat for energy and chemicals research and development program of NRC (Canada), 8:11700 (RA:US)
Peat research in Finland, 8:11580 (RA:US)
Peat research and development in Sweden, 8:11750 (RA:US)
Resource Assessment
Alabama peat resources project, 8:11702 (RA:US)
Alaska peat resource estimate, 8:11703 (RA:US)
Florida peat resource assessment project, 8:11704 (RA:US)
Louisiana peat resources assessment, 8:11706 (RA:US)
Maine peat resource evaluation program, 8:11708 (RA:US)
Overview of state peat resource programs, 8:11701 (RA:US)
Peat for energy and chemicals research and development program of NRC (Canada), 8:11700 (RA:US)
Peat resource estimation in Georgia, 8:11705 (RA:US)
Peat resource definition and utilization in Massachusetts, 8:11707 (RA:US)
Peat resource estimate in Michigan, 8:11709 (RA:US)
Peat resource assessment for the State of New York, 8:11711 (RA:US)
Peat resources of North Carolina, 8:11712 (RA:US)
Peat resource estimation in Rhode Island, 8:11713 (RA:US)
Peat resource estimation in South Carolina, 8:11714 (RA:US)
Second technical contractors' conference on peat, 8:11600 (R:US)
State resource estimation: Alaska, 8:11693 (RA:US)
State resource estimation: Maine, 8:11694 (RA:US)
State resource estimation: Michigan, 8:11695 (RA:US)
State resource estimation: Minnesota, 8:11696 (RA:US)
State resource estimation: North Carolina, 8:11697 (RA:US)
State resource estimation: South Carolina, 8:11698 (RA:US)
Status of the Minnesota peat inventory project (April, 1982), 8:11710 (RA:US)
Resource Development
Environmental data requirements and analysis for development of peat program, 8:11688 (RA:US)
Socio-Economic Factors
Socioeconomic issues associated with the use of peat as an energy resource, 8:11689 (RA:US)
Specifications
Comprehensive use of peat in the USSR, 8:11727 (RA:US)
Storage
Peat research in Finland, 8:11580 (RA:US)
Surface Mining
Conceptual designs for peat production systems, 8:11728 (RA:US)
Evaluation of environmental issues on the use of peat as an energy source, 8:11690 (RA:US)
Fifth technical contractors' conference on peat, 8:11579 (R:US)
Testing of sod peat equipment and elucidation of sod dewatering characteristics, 8:11729 (RA:US)
Testing
Peat testing standardization, 8:11666 (RA:US)
Water Removal
High pressure wet carbonization of peat, 8:11608 (RA:US)
Peat conversion and utilization in the United States, 8:11719 (RA:US)
Peat dewatering: solvent extraction (Benzene and diethyl ketone), 8:11747 (RA:US)
Peat pretreatment: High-pressure wet carbonization, 8:11603 (RA:US)
Peat research and development in Sweden, 8:11750 (RA:US)
Production of fuel grade peat at First Colony Farms, Inc., 8:11739 (RA:US)
Second technical contractors' conference on peat, 8:11600 (R:US)
Water retention properties of peat and their modification, 8:11748 (RA:US)
Water retention mechanisms in peat, 8:11749 (RA:US)
Wet oxidation of peat, 8:11667 (RA:US)

PEATGAS PROCESS
Comparative Evaluations
Comparative analysis of peat gasification reactor configurations, 8:11611 (RA:US)
Pilot Plants
Peatgas pilot plant status (Tests PT-4 and PT-5), 8:11609 (RA:US)

PELLETS (FUEL)
See FUEL PELLETS

PENNSYLVANIA
Energy Policy
Transportation energy savings from a national conservation program: a case study of Pennsylvania, 8:12602 (RA:US)
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)

PEOPLE
See HUMAN POPULATIONS

PEP STORAGE RINGS
Muon Detection
Physics with the MAC detector, 8:12940 (R:US)
Radiation Detectors
Recent results from the MAC and MARK II detectors at PEP, 8:12932 (R:US)
SLAC Mark II Detector (Engineering Materials), 8:13002 (E:US)

PEPTIDE HYDROLASES
Code number 3.4.

Enzyme Inhibitors
Protease inhibitors neither damage DNA nor interfere with DNA repair or replication in human cells, 8:13113 (J:NL)

PERHYDROXYL RADICAL
See HYDROPEROXY RADICALS

PEROXIDES
Chemical Reactions
ESR study of the attack of photolytically produced hydroxyl radicals on α-methyl-D-glucopyranoside in aqueous solution, 8:12822 (J:US)

PERSONNEL
Studies of groups of persons employed in a particular field of endeavor. For studies on individuals in a group see also MAN.
See also MEDICAL PERSONNEL
MINERS
REACTOR OPERATORS
Decontamination
1976 Hanford americium-exposure incident: external decontamination procedures, 8:13145 (R:US)
1976 Hanford americium-exposure incident: decontamination and treatment facility (Procedures and equipment for handling injured employee), 8:13146 (R:US)
1976 Hanford americium-exposure incident: urinary excretion of trace metals during DTPA treatments, 8:13151 (R:US)
Physiology
The physiological limitation of working in a radiation containment suit, 8:12860 (J:US)
Protective Clothing
The physiological limitation of working in a radiation containment suit, 8:12860 (J:US)
Radiation Accidents
1976 Hanford Americium exposure incident: hematologic effects, 8:13149 (R:US)
Radiation Injuries
1976 Hanford americium-exposure incident: external decontamination procedures, 8:13145 (R:US)
Radiation Protection
The physiological limitation of working in a radiation containment suit, 8:12860 (J:US)

PERSONNEL DOSIMETRY
Meetings
Eighth DOE workshop on personnel neutron dosimetry (Lead abstract), 8:13393 (R:US)
Program Management
DOE Neutron Dosimetry Upgrade Program, 8:13394 (RA:US)

PERSONNEL FILM DOSIMETRY
See PERSONNEL DOSIMETRY

PERSONNEL MONITORING
Albedo-Neutron Dosemeters
Results of routine monitoring with albedo-dosemeters, 8:12959 (RA:DE:In German)
Contamination
Determination of skin dose in personnel contamination, 8:13387 (RA:DE:In German)
Data Acquisition
Organizational measures to be taken to enable the official dose records offices to meet the requirements of legislation, 8:13390 (RA:DE:In German)
Data Processing
Current state in the establishment of a central personal dose registry, 8:13391 (RA:DE:In German)
Neutron Dosimetry
Results of an international comparitive evaluation of neutron dosemeters for personnel monitoring, 8:13383 (RA:DE:In German)
Photographic Film Dosemeters
Computer-aided dose determination and methods of occupational dose analysis using film, 8:13389 (RA:DE:In German)
Thermoluminescent Dosemeters
Occupational radiation exposure in Austria - results of personnel monitoring using thermoluminescent dosemeters, 8:13388 (RA:DE:In German)

PETALITE
Thermodynamic Properties
Thermodynamic proprties of petalite ($Li_2Al_2Si_8O_{20}$), 8:13215 (R:US)

PETRA STORAGE RING
Benchmarks
Geodetic control surveys at PETRA, 1981/1982, 8:12941 (TG:US)
Geodetic Surveys
Geodetic control surveys at PETRA, 1981/1982, 8:12941 (TG:US)

PETROLEUM
Limited to crude oil; see also COAL LIQUIDS, SHALE OIL, etc.
Chemical Analysis
Determination of miscibility pressure by direct-observation method. Quarterly report, July 1-September 30, 1982, 8:11797 (R:US)
Laser excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons, 8:12758 (R:US)
Uranium content of petroleum by fission track technique, 8:12761 (R:BR)
Coalescence
Magnitude and role of dynamic interfacial effects in low tension flooding, 8:11806 (J:US)
Distillation
Correlation of petroleum component properties for caustic flooding, 8:12772 (J:US)
Domestic Supplies
Evaluation of policy options for increasing domestic oil inventories. Volume 2. Policies to increase petroleum inventories in the secondary and tertiary sectors. Final report, 8:11790 (R:US)
Emulsification
Oil banking phenomena in surfactant/polymer and caustic flooding: droplet coalescence and entrapment processes, 8:11805 (J:US)
Energy Supplies
Report to the Congress: comprehensive energy - emergency response procedures, 8:11810 (R:US)
Enhanced Recovery
Enhanced oil recovery: environmental issues and state regulatory programs, 8:13063 (J:GB)
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Interfacial phenomena in enhanced oil recovery, 8:11799 (B:US)
SPE/DOE symposium on enhanced oil recovery. Proceedings supplement, 8:11792 (R:US)
Fuel Substitution
Makret place economics and coal conversions (Cents/million Btu; 1975 to 1981), 8:12268 (RA:US)
Inventories
Evaluation of policy options for increasing domestic oil inventories. Final report, 8:11789 (R:US)
Leaching
Correlation of petroleum component properties for caustic flooding, 8:12772 (J:US)
Partition
Development of a rapid and accurate method for determining partition coefficients of chemical tracers between oils and brines (for single well tracer tests). Final report, 8:11796 (R:US)
Phase Studies
Ultra-low IFT, phase behavior and microstructure in oil/brine/surfactant/alcohol systems, 8:11802 (J:US)
Prices
Makret place economics and coal conversions (Cents/million Btu; 1975 to 1981), 8:12268 (RA:US)
Synthetic fuel costs vs oil price (Forecasting; graph shows dependence of copper, aluminum, steel, CE index, CMR index, cement and coal prices on oil prices), 8:11776 (RA:US)
When should you build a synthetic fuel plant, 8:11777 (RA:US)
Production
Liquid crystals and microemulsions in oil recovery, 8:11801 (J:US)
Low-rank coal exploitation and utilization in east European countries (USSR; 1950 to 1979), 8:11734 (RA:US)

Potential for commercial synthetic fuels in the US energy future (Forecasting), 8:12492 (RA:US)
Refining
Oil refining flexibility and alternative fuels (Brazil), 8:11807 (RA:BR)
Shortages
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)
Supply Disruption
Report to the Congress: comprehensive energy - emergency response procedures, 8:11810 (R:US)

PETROLEUM COKE
See COKE
PETROLEUM PRODUCTS

PETROLEUM DEPOSITS
See also OIL FIELDS
Exploration
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R:US)

PETROLEUM INDUSTRY
Fuel Cycle
Comparing the health and environmental hazards of different energy systems, 8:13100 (R:US)
Manpower
Forecasts of on-site and off-site occupational requirements for energy-construction developments in the United States, 1982 to 2000, 8:12465 (R:US)
Statistics
Wyoming's oil and gas industry. Public information circular No. 17, 8:11788 (R:US)

PETROLEUM PRODUCTS
See also DIESEL FUELS
FUEL OILS
GASOLINE
LIQUEFIED PETROLEUM GASES
Steam Reformer Processes
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)

PETROLEUM REFINERIES
Economic Analysis
Impacts of alternative-engine technology on the refining industry, 8:11809 (R:US)
Energy Analysis
Refinery energy profile. Final report, 8:11808 (R:US)
Energy Efficiency
Refinery energy profile. Final report, 8:11808 (R:US)

PETROLEUM SULFONATES
Structural Chemical Analysis
Liquid crystals and microemulsions in oil recovery, 8:11801 (J:US)
Surface Tension
Fluid microstructures and enhanced oil recovery, 8:11800 (J:US)

PHASE CHANGE MATERIALS
Use with the specific phase change material (e.g. calcium chloride) when known.
Heat Transfer
Fundamental heat-transfer processes related to phase-change thermal-storage media, 8:12452 (R:US)

PHENANTHRENE
Solubility
Supercritical behavior in multicomponent system (Solubility in CO_2 or C_2H_4; pressure and concentration dependence), 8:11635 (RA:US)

PHENIX REACTOR
Reactor Operation
Selected safety-related events reported in May and June 1982, 8:12427 (J:US)
Reactor Safety
Selected safety-related events reported in May and June 1982, 8:12427 (J:US)

PHENOLS
See also NAPHTHOLS
Phosphorescence
Solid-surface luminescence analysis. Progress report, June 1980-October 1982, 8:12804 (R:US)

PHOSPHATIDES
See PHOSPHOLIPIDS

PHOSPHOLIPIDS
Agglomeration
Aggregation of low density lipoproteins with unilamellar phosphatidylcholine vesicles, 8:13109 (J:US)

PHOSPHONIC ACID ESTERS
Synthesis
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)

PHOSPHONIC ACIDS
Synthesis
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)

PHOSPHORUS
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

PHOSPHORUS 32
Biological Effects
Inducible cadmium binding complexes of cabbage and tobacco, 8:13111 (J:US)

PHOSPHORUS COMPOUNDS
Relaxation Time
Direct spectrum-analysis method for obtaining the relaxation-time spectrum from relaxation-response data: amorphous metals ($Fe_{40}Ni_{40}P_{14}B_6$), 8:12684 (R:US)

PHOTOANODES
Stabilization
Electrochemical photovoltaic cells/stabilization and optimization of II-VI semiconductors. Third technical progress report, 1 October-31 December 1979, 8:12093 (R:US)

PHOTOCHEMISTRY
Research Programs
Nature of oxygen-containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, July 1981-June 1982, 8:12820 (R:US)
Radiation-induced effects in organic systems. Final report, 8:12819 (R:US)

PHOTODIODES
Physical Radiation Effects
Computer modeling and radiation testing of AlGaAs photodiode structures, 8:13004 (J:US)

PHOTODISINTEGRATION
See PHOTONUCLEAR REACTIONS

PHOTOELECTROCHEMICAL CELLS
Laser spot scanning of photoelectrochemical cells. Technical report, 8:12023 (R:US)
Photoanodes
Electrical properties of WSe_2, WS_2, $MoSe_2$, MoS_2, and their use as photoanodes in a semiconductor/liquid junction solar cell, 8:12062 (R:US)
Electrochemical photovoltaic cells/stabilization and optimization of II-VI semiconductors. Third technical progress report, 1 October-31 December 1979, 8:12093 (R:US)

PHOTOELECTRON SPECTROSCOPY
Computer Calculations
Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_3Mo_3Cl_8H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters, 8:12785 (R:US)

PHOTOGRAPHIC FILM DETECTORS
Comparative Evaluations
Evaluation of experiences in long-term radon and radon-daughter measurements, 8:13044 (R:US)

PHOTOGRAPHIC FILM DOSEMETERS
Energy Dependence
Toward a sub-MeV personnel neutron dosimeter, 8:12984 (RA:US)
Performance
Toward a sub-MeV personnel neutron dosimeter, 8:12984 (RA:US)
PHOTOMAGNETIC EFFECT
See VISIBLE RADIATION
PHOTOMAGNETOELECTRIC EFFECT
See MAGNETIC FIELDS
PHOTON ACTIVATION ANALYSIS
See ACTIVATION ANALYSIS
PHOTON DETECTION (GAMMA)
See GAMMA DETECTION
PHOTON TRANSPORT
Computer Codes
UNSPEC reference manual: 10/29/82 version, 8:13379 (R:US)
PHOTONUCLEAR REACTIONS
Delbrueck Scattering
Photon-nucleus interaction at the energies below the photonuclear reaction threshold, 8:13370 (RA:SU:In Russian)
Elastic Scattering
Photon-nucleus interaction at the energies below the photonuclear reaction threshold, 8:13370 (RA:SU:In Russian)
Inelastic Scattering
Photon-nucleus interaction at the energies below the photonuclear reaction threshold, 8:13370 (RA:SU:In Russian)
PHOTOSYNTHESIS
Charge separation in the light reactions of photosynthesis, 8:13128 (BA:US)
Biochemistry
Investigation of electron-transport mechanisms in photosynthesis. Final report, 8:13127 (R:XE)
Biological Pathways
Energy transfer in self-assembled chlorophyll a systems, 8:13110 (J:GB)
Biomimetic Processes
Role of porphyrins and chlorophylls in artificial photosynthesis, 8:12816 (R:US)
Electron Transfer
Role of porphyrins and chlorophylls in artificial photosynthesis, 8:12816 (R:US)
PHOTOVOLTAIC CELLS
See also SOLAR CELLS
Energy resources in California, 8:12483 (R:US)
PHOTOVOLTAIC POWER PLANTS
Environmental Impacts
Possible effects of solar energy conversion on meteorological conditions, 8:12018 (RA:CH)
PHOTOVOLTAIC POWER SUPPLIES
Combined Collectors
Intermediate photovoltaic system application experiment operational performance report. Volume 1. Dallas-Fort Worth Regional Airport, TX, July 1982, 8:12113 (R:US)
Intermediate photovoltaic system application experiment operational performance report. Volume 4. For G.N. Wilcox Memorial Hospital, Kauai, Hawaii for June, July, and August 1982, 8:12112 (R:US)
Computerized Simulation
Impact of residential utility-interactive PV-power systems on the utility, 8:12111 (R:US)
Design
Initial detailed designs for intermediate photovoltaic systems: office building, 8:12118 (R:US)
Environmental Impacts
Photovoltaics: state-of-knowledge survey of environmental, health and safety aspects, 8:12046 (R:US)
Health Hazards
Photovoltaics: state-of-knowledge survey of environmental, health and safety aspects, 8:12046 (R:US)
Marketing Research
Worldwide market for photovoltaics in the rural sector, 8:12015 (R:US)
Performance
Initial detailed designs for intermediate photovoltaic systems: office building, 8:12118 (R:US)
Intermediate photovoltaic system application experiment operational performance report. Volume 1. Dallas-Fort Worth Regional Airport, TX, July 1982, 8:12113 (R:US)
Intermediate photovoltaic system application experiment operational performance report. Volume 3. For Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma, 8:12116 (R:US)
Intermediate photovoltaic system application experiment operational performance report. Volume 4. For G.N. Wilcox Memorial Hospital, Kauai, Hawaii for June, July, and August 1982, 8:12112 (R:US)
Intermediate photovoltaic system application experiment operational performance report. Volume 14. For Lovington Square Shopping Center, Lovington, New Mexico, July and August 1982, 8:12114 (R:US)
Intermediate photovoltaic system application experiment, July and August 1982 operational performance report. Volume 14. For Newman Power Station, El Paso, Texas, 8:12115 (R:US)
Intermediate photovoltaic system application experiment operational performance report. Volume 6. For Oklahoma Center for Science and Arts, Oklahoma City, OK for October 1982, 8:12117 (R:US)
Power Conditioning Circuits
Power processing subsystems for the 100-kWp solar-photovoltaic-power system at the Natural Bridges National Monument in Utah, 8:12110 (R:US)
Safety
Photovoltaics: state-of-knowledge survey of environmental, health and safety aspects, 8:12046 (R:US)
Technology Assessment
Technological aspects of solar energy utilization, 8:12107 (RA:CH)
Uses
Technological aspects of solar energy utilization, 8:12107 (RA:CH)
PHTHALIC ACID ESTERS
Polymerization
Method for the preparation of polymers, 8:12729 (TG:US)
Synthesis and characterization of diallyl phthalate prepolymers, 8:12722 (R:US)
PHYSICAL RADIATION EFFECTS
Theoretical relationships between creep and swelling by point defect absorption during irradiation, 8:12660 (R:US)
Research Programs
Department of Metallurgy and Materials research report, 1981-82, 8:12658 (R:GB)
PHYSICS
See also ATOMIC PHYSICS
HIGH ENERGY PHYSICS
NUCLEAR PHYSICS
REACTOR PHYSICS
Meetings
Sixth conference of Czechoslovak physicists. Part 2, 8:13224 (R:CS:CZ)
Sixth conference of Czechoslovak physicists. Part 1. Vol. 2, 8:13223 (R:CS:CZ)
Sixth conference of Czechoslovak physicists. Part 1. Volume 1, 8:13225 (R:CS:CZ)
PHYTOPLANKTON
Baseline Ecology
Light, temperature and nitrogen as interacting factors affecting diel vertical migrations of dinoflagellates in culture, 8:13079 (J:GB)
Migration
Light, temperature and nitrogen as interacting factors affecting diel vertical migrations of dinoflagellates in culture, 8:13079 (J:GB)
PIGE ANALYSIS
See PROTON REACTIONS
PIGMENT CELLS
See ANIMAL CELLS
PINES
Habitat
Bird communities and vegetation structure in pine plantations of the southeastern Coastal Plain, 8:13052 (R:US)

PINS (FUEL)
See FUEL PINS
PION CONDENSATION
Charge-exchange 1^+ excitations and precritical phenomena in the atomic nuclei, 8:13304 (RA:SU:In Russian)
PION MINUS-PROTON INTERACTIONS
Particle Production
Double Regge exchange in rho $\Delta\pi$ and rho rho N final states from π^- p interactions at 8 GeV/c, 8:13257 (R:US)
Peripheral Models
Double Regge exchange in rho $\Delta\pi$ and rho rho N final states from π^- p interactions at 8 GeV/c, 8:13257 (R:US)
PION PLUS-NEUTRON INTERACTIONS
Cross Sections
Phi production and the OZI rule in π^+ d interactions at 10 GeV/c, 8:13263 (R:US)
PION PLUS-PROTON INTERACTIONS
Cross Sections
Phi production and the OZI rule in π^+ d interactions at 10 GeV/c, 8:13263 (R:US)
PION REACTIONS
Research Programs
Physics Division annual review, 1 April 1980-31 March 1981, 8:13293 (R:US)
PION-NUCLEON INTERACTIONS
Pair Production
Dimuon production in hadronic interactions, 8:13258 (R:US)
Forward dimuons from πN interactions at Fermilab: design and construction of a scintillation-counter hodoscope, 8:13278 (R:US)
Transverse momentum spectra of dimuons produced in hadronic interactions and comparison with QCD, 8:13259 (R:US)
Particle Production
Dimuon production in hadronic interactions, 8:13258 (R:US)
PIPELINE QUALITY GAS
See HIGH BTU GAS
PIPELINES
See also FREIGHT PIPELINES
Energy Consumption
Prospects for energy conservation in the pipeline industry, 8:12589 (RA:US)
Repair
Suction trenching, and the use of fly ash for backfilling, 8:11822 (TJ:GB)
Scrapers
Tests of cryogenic pigs for use in liquefied gas pipelines, 8:11821 (R:US)
PIPES
Materials
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
PISUM
Cell Differentiation
Cells of pea (Pisum sativum) that differentiate from G2 phase have extrachromosomal DNA, 8:13107 (J:US)
PITTSBURG-MIDWAY SOLVENT REFINED COAL PRO
See SRC PROCESS
PLAGIOCLASE
See ANORTHOSITES
PLAGIOCLASITE
See ANORTHOSITES
PLANTS
See also ALGAE
CASSAVA
FUNGI
GRASS
SUNFLOWERS
TRADESCANTIA
TREES
Biological Stress
Effects of increased CO_2 on photosynthesis and agricultural productivity. Volume II, Part 6. Environmental and societal consequences of a possible CO_2-induced climate change, 8:13025 (R:US)
Populations
Unconventional plants for biomass feedstocks in semi-arid West Texas. Final report, 8:12101 (R:US)
Productivity
Unconventional plants for biomass feedstocks in semi-arid West Texas. Final report, 8:12101 (R:US)
PLANTS (INDUSTRIAL)
See INDUSTRIAL PLANTS
PLANTS (POWER)
See POWER PLANTS
PLASMA
See also COLLISIONLESS PLASMA
HIGH-BETA PLASMA
HOT PLASMA
LASER-PRODUCED PLASMA
Plasma surface interactions in controlled fusion devices. Report on the fifth international conference, Gatlinburg, Tennessee, United States of America, 3-7 May 1982, 8:13455 (J:AT)
Electric Charges
Debye shielding of a moving test charge in plasma, 8:13461 (J:GB)
Magnetic Field Reversal
Reply to Comments by W.N. Hugrass on the paper by N.J. Fisch, T. Watanabe "Field reversal by rotating waves" (Nucl. Fusion 22 (1982) 423), 8:13454 (J:AT)
Relaxation Losses
Relaxation oscillations in a bounded magnetized plasma, 8:13457 (J:GB)
Reverse-Field Pinch
Classical transport coefficients in a field-reversed configuration, 8:13458 (J:GB)
Spectroscopy
Spectroscopic density measurements in compressed plasmas, 8:13527 (BA:US)
Tearing Instability
Linear theory of electromagnetic instabilities in plasmas with a hollow q-profile, 8:13453 (J:AT)
PLASMA DIAGNOSTICS
Laser Radiation
Investigation of transport processes in the wall zone of helium plasma by means of spectroscopical methods, 8:13434 (R:DE:In German)
Laser applications, 8:13427 (RA:DE:In German)
Laser applications, 8:13432 (RA:DE:In German)
Reviews
Diagnostics for neutral-beam-heated tokamaks, 8:13446 (R:US)
PLASMA FOCUS
Electric Discharges
Plasmafocus, 8:13428 (RA:DE:In German)
Ion Sources
Plasmafocus, 8:13484 (RA:DE:In German)
Magnetic Spectrometers
Particle beams generated by a 6-12.5 kJ dense plasma focus, 8:13502 (J:AT)
Neutron Sources
Plasmafocus, 8:13484 (RA:DE:In German)
Plasma Microinstabilities
Plasmafocus, 8:13428 (RA:DE:In German)
Research Programs
Research report 1980, 8:13424 (R:DE:In German)
Research report 1979, 8:13429 (R:DE:In German)
Scattering
Light scattering measurements on plasma focus, 8:13433 (R:DE:In German)
PLASMA HEATING
See also HIGH-FREQUENCY HEATING
Simulation
Alpha-particle simulation and diagnostics using $_3He^{++}$ minority ICRF heating, 8:13450 (R:US)
PLASMA INSTABILITY
Oscillation Modes
Perturbative study of the spectrum of large toroidal mode number ideal MHD instabilities, 8:13460 (J:GB)
Perturbation Theory
Rayleigh-Schroedinger perturbation theory for unstable modes of a high-β cylindrical tokamak, 8:13463 (J:GB)
Rayleigh-Schroedinger Formula
Rayleigh-Schroedinger perturbation theory for unstable modes of a high-β cylindrical tokamak, 8:13463 (J:GB)

Toroidal Configuration
Perturbative study of the spectrum of large toroidal mode number ideal MHD instabilities, 8:13460 (J:GB)
PLASMA OSCILLATIONS
See PLASMA WAVES
PLASMA SIMULATION
Wave and plasma heating, 8:13425 (RA:DE:In German)
PLASMA WAVES
Inhomogeneous Plasma
Wave and plasma heating, 8:13425 (RA:DE:In German)
Wave Propagation
Waves and plasmaheating, 8:13430 (RA:DE:In German)
PLASMIN
See FIBRINOLYSIN
PLASTIC FOAMS
Extrusion
Rheology of thermoplastic foam extrusion, 8:12725 (R:US)
PLASTIC SCINTILLATION COUNTERS
See PLASTIC SCINTILLATION DETECTORS
PLASTIC SCINTILLATION DETECTORS
Energy Resolution
Lead-glass gamma-ray detector for relativistic heavy-ion collisions, 8:12995 (J:NL)
Multi-Channel Analyzers
Simple multifunction discriminator for multichannel triggers, 8:12973 (R:US)
PLATES
Thicker than SHEETS or FOILS.
Aerodynamic Heating
LOVEL: a low-velocity aerodynamic heating code for flat-plates, wedges, and cones, 8:12872 (R:US)
Finite Element Method
Finite element for plates and shells, 8:12853 (R:BR:In Portuguese)
PLATFORM MOUNTED NUCLEAR PLANT
See OFFSHORE NUCLEAR POWER PLANTS
PLATINUM
Catalytic Effects
Dehydrogenation processes on nickel and platinum surfaces. Conversion of cyclohexane, cyclohexene, and cyclohexadiene to benzene, 8:12810 (J:US)
Crystallography
LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R:US)
Sorptive Properties
LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R:US)
Surface Properties
LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R:US)
PLESIOTHERAPY
See RADIOTHERAPY
PLT DEVICES
Gas Injection
Density rise experiment on PLT, 8:13501 (J:AT)
Runaway Electrons
Sawtooth oscillations in the flux of runaway electrons to the PLT limiter, 8:13509 (J:AT)
PLUTONIUM
Chemistry
Plutonium roundtable discussion, 8:12824 (R:US)
Counting Techniques
Inventory-sample coincidence-counter manual, 8:11939 (R:US)
Deposition
Stack-released plutonium in the terrestrial environment of a chemical separations facility, 8:13067 (J:US)
Meetings
Plutonium roundtable discussion, 8:12824 (R:US)
Nondestructive Analysis
Selected measurement data for plutonium and uranium, 8:11940 (R:US)
Technical plan for the development of an assay system for INEL-stored TRU waste, 8:11933 (R:US)
Particle Resuspension
Characteristics of airborne plutonium resuspended from near-background aged surface-sources, 8:13047 (R:US)
Radioecological Concentration
Characteristics of airborne plutonium resuspended from near-background aged surface-sources, 8:13047 (R:US)
Plutonium contamination of the 'Altrhein' river, 8:13088 (R:DE:In German)
Stack-released plutonium in the terrestrial environment of a chemical separations facility, 8:13067 (J:US)
Redox Potential
Thermodynamic properties of chemical species in nuclear waste, 8:12825 (R:US)
PLUTONIUM 234
Production
Additional Pu-238 production, 8:11952 (R:US)
Radioisotope Heat Sources
Additional Pu-238 production, 8:11952 (R:US)
PLUTONIUM 238
Production
Radioisotopes for heat-source applications, 8:11953 (R:US)
Radioisotope Heat Sources
^{238}Pu fuel form processes. Quarterly report, April-June 1982, 8:11950 (R:US)
Radioisotopes for heat-source applications, 8:11953 (R:US)
Surface studies of iridium-alloy grain boundaries associated with weld cracking, 8:11949 (R:US)
PLUTONIUM 239
Biological Localization
Effects of monomeric ^{239}Pu on the pregnant rabbit (Blood clotting), 8:13167 (J:GB)
Inhalation
Distribution of inhaled $^{239}PuO_2$ in rat and hamster lung, 8:13165 (J:GB)
Isotope Ratio
Am-241/Pu-239 + 240 ratios in the marine environment, 8:13094 (J:GB)
Lung Clearance
Distribution of inhaled $^{239}PuO_2$ in rat and hamster lung, 8:13165 (J:GB)
Radioecological Concentration
Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R:US)
Sediment and radionuclide transport in rivers: radionuclide transport modeling for Cattaraugus and Buttermilk Creeks, New York, 8:13090 (R:US)
Sorption
Am-241/Pu-239 + 240 ratios in the marine environment, 8:13094 (J:GB)
PLUTONIUM 239 TARGET
Neutron Reactions
Analysis of the average ^{235}U, ^{238}U and ^{239}Pu fission cross sections on ^{235}U and ^{252}Cf fission neutron spectra, 8:13351 (RA:SU:In Russian)
PLUTONIUM 240
Isotope Ratio
Am-241/Pu-239 + 240 ratios in the marine environment, 8:13094 (J:GB)
Radioecological Concentration
Sediment and radionuclide transport in rivers: radionuclide transport modeling for Cattaraugus and Buttermilk Creeks, New York, 8:13090 (R:US)
Sorption
Am-241/Pu-239 + 240 ratios in the marine environment, 8:13094 (J:GB)
PLUTONIUM COMPLEXES
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
PLUTONIUM DIOXIDE
Fabrication
Improved specifications for fast reactor fuel, 8:12370 (R:US)
PLUTONIUM OXIDES
See also PLUTONIUM DIOXIDE

Dissolution
Pt. 1: Dissolution of plutonium oxide during the process, 8:11884 (RA:XE:In German)
PLUTONIUM RECYCLE
Radioactive Waste Management
Plutonium fuel fabrication residues and wastes, 8:11865 (R:FR)
PNA
See POLYCYCLIC AROMATIC HYDROCARBONS
PNL
See BATTELLE PACIFIC NORTHWEST LABORATORIES
POCKET CALCULATORS
See CALCULATORS
POINT CONTACTS
See ELECTRIC CONTACTS
POINT MUTATIONS
See GENE MUTATIONS
POISSON EQUATION
Numerical solution of large sparse linear systems, 8:13541 (R:FR:In French)
POLARIZED TARGETS
Polarization
System for measuring of proton polarization in polarized target, 8:12924 (R:SU:In Russian)
POLICY
See ENERGY POLICY
ENVIRONMENTAL POLICY
POLIO VIRUS
Biochemistry
Membrane-associated precursor to poliovirus VPg identified by immunoprecipitation with antibodies directed against a synthetic heptapeptide, 8:13108 (J:US)
POLOIDAL DIVERTOR EXPERIMENT
See PDX DEVICES
POLONIUM 209
Alpha Decay
Simplified and semisimplified α-decay of N=125 nuclei and effective nucleon-nucleon interaction, 8:13345 (RA:SU:In Russian)
POLYACETYLENES
Agglomeration
Agglomeration of polyacetylenic particulates and its relation to soot formation, 8:12821 (RA:US)
POLYACRYLONITRILE
See ORGANIC POLYMERS
POLYATOMIC MOLECULES
Energy-Level Transitions
Molecular Rydberg transitions. X. correlation algorithms for Rydberg term values, 8:13246 (J:DE)
Rydberg Correction
Molecular Rydberg transitions. X. correlation algorithms for Rydberg term values, 8:13246 (J:DE)
POLYCYCLIC AROMATIC HYDROCARBONS
Fluorescence Spectroscopy
Fluorescence-line-narrowing spectrometry of polycyclic aromatic hydrocarbons in organic glasses (Pyrene, 1-alkylpyrene, benzo(e)pyrene, benzo(a)pyrene, benzo(k)fluoranthene, perylene), 8:12755 (R:US)
Gas Chromatography
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Gravimetric Analysis
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Laser Spectroscopy
Laser excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons, 8:12758 (R:US)
Mass Spectroscopy
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
POLYESTERS
Chemical Preparation
Method for the preparation of polymers, 8:12729 (TG:US)
POLYETHERS
See POLYETHYLENE GLYCOLS
POLYETHYLENE GLYCOLS
Research Programs
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
Solvent Properties
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
Synthesis
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
POLYETHYLENE OXIDES
See POLYETHYLENE GLYCOLS
POLYETHYLENE TERPHTHALATE
See POLYESTERS
POLYETHYLENES
See also MARLEX
Equations of State
Simple EOS for branched (low-density) polyethylene, 8:12723 (R:US)
Fabrication
Neutron-shielding material. Translated from the Japanese, 8:13374 (R:US)
POLY(ISOBUTYLENE OXIDE)
See ORGANIC POLYMERS
POLYMER FLOODING
See MICROEMULSION FLOODING
WATERFLOODING
POLYMERS
See also ORGANIC POLYMERS
SILICONES
Materials Testing
Uv protective coatings for heliostats and the plastic dome. Final technical report, 8:12119 (R:US)
Research Programs
Department of Metallurgy and Materials research report, 1981-82, 8:12658 (R:GB)
Synthesis
Synthesis and characterization of diallyl phthalate prepolymers, 8:12722 (R:US)
POLYNUCLEAR AROMATIC HYDROCARBONS
See POLYCYCLIC AROMATIC HYDROCARBONS
POLYPEPTIDES
Biochemistry
Membrane-associated precursor to poliovirus VPg identified by immunoprecipitation with antibodies directed against a synthetic heptapeptide, 8:13108 (J:US)
Precipitation
Membrane-associated precursor to poliovirus VPg identified by immunoprecipitation with antibodies directed against a synthetic heptapeptide, 8:13108 (J:US)
Structural Chemical Analysis
Three mutations in Zea mays affecting zein accumulation: a comparison of zein polypeptides, in vitro synthesis and processing, mRNA levels, and genomic organization, 8:13106 (J:US)
POLYSACCHARIDES
See also CELLULOSE
LIGNIN
NITROCELLULOSE
STARCH
Electrochemistry
Survey of the electrochemistry of some biomass-derived compounds, 8:12097 (R:US)
POLYSULFIDES
See SULFIDES
POLYTETRAOXANE
See ORGANIC POLYMERS
POLYTHENE
See POLYETHYLENES
POLYTHIONATES
See SULFUR COMPOUNDS
POLYTHIONIC ACIDS
See INORGANIC ACIDS
SULFUR COMPOUNDS
POOR PEOPLE
See LOW INCOME GROUPS

POPULATION DYNAMICS
Biological Radiation Effects
Application of a surplus production model to assess environmental impacts on exploited populations of Daphnia pulex in the laboratory, 8:13159 (J:GB)
Mathematical Models
Long-term dynamics of forest ecosystems, 8:13056 (J:US)
POROUS MATERIALS
Incompressible Flow
Experimental and numerical studies of natural convection in a Hele-Shaw cell, 8:12873 (R:US)
Physical Properties
Physical properties of porous geologic materials, 8:13202 (J:US)
Rock-Fluid Interactions
Porous rock-fluid systems at elevated temperatures and pressures, 8:12255 (J:US)
PORPHYRINS
See also CHLOROPHYLL
Electron Transfer
Role of porphyrins and chlorophylls in artificial photosynthesis, 8:12816 (R:US)
POSITION SENSITIVE DETECTORS
Charge Collection
Charge collection in silicon strip detectors, 8:12943 (R:US)
Spatial Resolution
Charge collection in silicon strip detectors, 8:12943 (R:US)
POSITRON BEAMS
Beam Production
Low-energy-positron production at the Livermore linac, 8:12934 (R:US)
POSITRON-ELECTRON-PROTON STORAGE RING
See PEP STORAGE RINGS
POTABLE WATER
See DRINKING WATER
POTASSIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Solvent Extraction
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
POWER CONDITIONING CIRCUITS
Computerized Simulation
Photovoltaic-array/power-conditioner interface, 8:12109 (R:US)
Equipment Interfaces
Photovoltaic-array/power-conditioner interface, 8:12109 (R:US)
POWER DEMAND
Forecasting
Bonneville Power Administration and Rural Electrification Administration actions and activities affecting utility participation in Washington Public Power Supply System Plants 4 and 5, 8:12506 (R:US)
POWER GENERATION
See also COGENERATION
Capacity
Generating capacity in US electric utilities: how is it used; how much is needed over the decade, 8:12505 (R:US)
Energy Sources
Past, present, and projected energy sources for electrical generation in Texas, 8:11736 (RA:US)
Forecasting
Methodology and results of the impacts of modeling electric utilities: a comparative evaluation of MEMM and REM, 8:12507 (R:US)
Fuel Consumption
Methodology and results of the impacts of modeling electric utilities: a comparative evaluation of MEMM and REM, 8:12507 (R:US)
Planning
Generating capacity in US electric utilities: how is it used; how much is needed over the decade, 8:12505 (R:US)
Research Programs
Simple method for estimating the maximum value of developing new electric power generation technologies, 8:12497 (R:US)
Technology Assessment
Simple method for estimating the maximum value of developing new electric power generation technologies, 8:12497 (R:US)
POWER PLANTS
See also DUAL-PURPOSE POWER PLANTS
FUEL CELL POWER PLANTS
HYDROELECTRIC POWER PLANTS
MHD POWER PLANTS
SOLAR POWER PLANTS
THERMAL POWER PLANTS
WIND POWER PLANTS
Construction
Plant construction and community stress, 8:12509 (J:US)
POWER POOLS
See INTERCONNECTED POWER SYSTEMS
POWER REACTORS
See also ANGRA-1 REACTOR
ANGRA-2 REACTOR
AVR REACTOR
BIBLIS-A REACTOR
BROWNS FERRY-3 REACTOR
CLINCH RIVER BREEDER REACTOR
COMANCHE PEAK-1 REACTOR
COMANCHE PEAK-2 REACTOR
DOEL-1 REACTOR
DOEL-2 REACTOR
EBR-2 REACTOR
KNK REACTOR
KUOSHENG-1 REACTOR
KUOSHENG-2 REACTOR
LINGEN REACTOR
LUCIE-1 REACTOR
MZFR REACTOR
OBRIGHEIM REACTOR
OYSTER CREEK-1 REACTOR
PALISADES-1 REACTOR
PHENIX REACTOR
RWE-BAYERNWERK REACTOR
SALEM-2 REACTOR
SAN ONOFRE-3 REACTOR
SEQUOYAH-1 REACTOR
SEQUOYAH-2 REACTOR
SNR-1 REACTOR
SPACE POWER REACTORS
STADE REACTOR
THREE MILE ISLAND-1 REACTOR
THREE MILE ISLAND-2 REACTOR
TURKEY POINT-3 REACTOR
VAK REACTOR
WUERGASSEN REACTOR
ZION-2 REACTOR
Fluid-Structure Interactions
Fluid-structure coupling in Lagrange-Lagrange and Euler-Lagrange descriptions, 8:12392 (R:XE)
Primary Coolant Circuits
Effects of an annular fluid on the critical speed of a rotating shaft, 8:12349 (R:FR)
Reactor Safety
Selected review of foreign safety research for nuclear power plants, 8:12417 (R:US)
POWER SYSTEMS
Includes electric power networks with associated generating and transmission facilities.
See also INTERCONNECTED POWER SYSTEMS
Computerized Simulation
Fabrication, interfacing, and testing of a special-purpose power-system simulator. Topical report, October 3-December 31, 1982, 8:12285 (R:US)
POWER TRANSMISSION
Health Hazards
Ohio River Basin energy study: health aspects, 8:12284 (R:US)
POWER TRANSMISSION LINES
Materials
Materials research for hydrogen-cooled superconducting power-transmission lines (SPTL). Part I. Liquid hydrogen as a dielectric. Part II. Superconducting materials. Annual report, January 1, 1981-December 31, 1981, 8:12668 (R:US)

POWERED SUPPORTS
Manufacturers
Longwall data bank. Quarterly project status report, August 28-November 28, 1982 and semiannual report No. 3, 8:11731 (R:US)
PRASEODYMIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
PRASEODYMIUM 142
Energy Levels
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
PRASEODYMIUM 148
Decay
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
Energy Levels
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
Isomers
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
PRASEODYMIUM ALLOYS
Phase Studies
Study of the anomalous behavior of the electrical resistivity in alloys near the $PrNi_{5.0}$ composition, 8:12682 (R:US)
PRECIPITATION SCAVENGING
Mathematical Models
Interpretations of the OSCAR data for reactive-gas scavenging, 8:13024 (R:US)
PREFABRICATED BUILDINGS
Direct Gain Systems
Manufactured buildings solar project. Final report, 8:12153 (R:US)
PRESSURE SUPPRESSION
Specifications
Suppression-pool temperature limits for BWR containments, 8:12406 (R:US)
PRESSURE VESSELS
Defects
Survey of defects in pressure vessels in the UK for the period 1962-1978 and its relevance to nuclear primary circuits, 8:12354 (R:GB)
Fabrication
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)
Materials
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Stress Analysis
Applications of energy release rate techniques to part-through cracks in plates and cylinders. Volume 1. ORMGEN-3D: a finite element mesh generator for 3-dimensional crack geometries, 8:12353 (R:US)
Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982 (PWR; BWR), 8:12294 (R:US)
Thermal Shock
Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982 (PWR; BWR), 8:12294 (R:US)
Thermal Stresses
The integrity of PWR pressure vessels during overcooling accidents, 8:12439 (J:US)
Welding
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)
PRESSURIZED WATER COOLED MODERATED REACTORS
See PWR TYPE REACTORS
PRESSURIZED WATER REACTORS
See PWR TYPE REACTORS
PRICES
Prior to June 1979, CHARGES was used.
Forecasting
Methodology and results of the impacts of modeling electric utilities: a comparative evaluation of MEMM and REM, 8:12507 (R:US)
PRIMARY COOLANT CIRCUITS
Corrosion Products
Study of the corrosion products in the primary system of PWR plants as the source of radiation fields build-up, 8:12299 (R:BE)
Pumps
Effects of an annular fluid on the critical speed of a rotating shaft, 8:12349 (R:FR)
PRINCETON LARGE TORUS
See PLT DEVICES
PROCESS DEVELOPMENT UNITS
Construction
Entrained flow pyrolysis of biomass, 8:12075 (RA:US)
Modifications
Steam gasification of biomass, 8:12070 (RA:US)
PROCESS SOLUTIONS
Chemical Analysis
Instrumental methods of analysis of sulfur compounds in synfuel process streams. Quarterly technical progress report, July-September 1982, 8:11670 (R:US)
PRODUCER GAS
130 to 140 Btu/ft³.
Hot Gas Cleanup
Systems model of the iron oxide hot-gas clean-up process. Volume 1. Theoretical and experimental results. Final report, September 1979-December 1980, 8:11660 (R:US)
PRODUCTION (HYDROGEN)
See HYDROGEN PRODUCTION
PROGRAMMING
Limited to computer programming.
See also LINEAR PROGRAMMING
Least Square Fit
Randomly generated test problems for positive definite quadratic programming, 8:13537 (R:US)
PROGRAMMING LANGUAGES
Specifications
ALECS: assembly language extensions and control structures, 8:13551 (R:US)
PROJECTION SPARK CHAMBERS
Spatial Resolution
Elimination of ambiguity in determining track space orientation in multigap projection spark chambers, 8:12970 (R:SU:In Russian)
PROLINE
Metabolism
Proline metabolism in plants under environmental stresses. Progress report, April 1, 1982-December 31, 1982, 8:13126 (R:US)
PROMETHIUM 144
Energy Levels
Radioactive decay studies at TRISTAN. Progress report, December 1, 1981-December 31, 1982, 8:13322 (R:US)
PROMETHIUM 147
Inventories
Strontium-90 and promethium-147 recovery, 8:11951 (R:US)
Production
Radioisotopes for heat-source applications, 8:11953 (R:US)
Radioisotope Heat Sources
Radioisotopes for heat-source applications, 8:11953 (R:US)
Strontium-90 and promethium-147 recovery, 8:11951 (R:US)
PRONGS
See PARTICLE TRACKS
1-PROPANOL
See PROPANOLS
2-PROPANOL
See PROPANOLS
PROPANOLS
Phase Studies
Liquid crystals and microemulsions in oil recovery, 8:11801 (J:US)
PROPORTIONAL COUNTERS
See also HE-3 COUNTERS

MULTIWIRE PROPORTIONAL CHAMBERS
Pulses
Dynamical properties of charge-dividing proportional counters, 8:12945 (R:XC)
Time Resolution
Parallel plate detectors, 8:12969 (R:FR:In French)
PROPULSION SYSTEMS
Energy Efficiency
Analysis and comparison of automotive-propulsion systems, 8:12647 (R:US)
Performance
Analysis and comparison of automotive-propulsion systems, 8:12647 (R:US)
PROPYL ALCOHOLS
See PROPANOLS
PROSTAGLANDINS
Biological Effects
Degradation of connective tissue matrices by macrophages. III. Morphological and biochemical studies on extracellular, pericellular, and intracellular events in matrix proteolysis by macrophages in culture, 8:13123 (J:US)
Regulation of the colony-stimulating activity produced by a murine marrow-derived cell line (H-1), 8:13120 (J:US)
PROTECTION
See SAFETY
PROTECTION (RADIATION)
See RADIATION PROTECTION
PROTECTIVE CLOTHING
The physiological limitation of working in a radiation containment suit, 8:12860 (J:US)
PROTECTIVE COATINGS
Materials Testing
Uv protective coatings for heliostats and the plastic dome. Final technical report, 8:12119 (R:US)
PROTEINS
See also GLUCOPROTEINS
LIPOPROTEINS
Biosynthesis
Control of proton efflux from corn root tissue by an injury-sensing mechanism, 8:13121 (J:NL)
Detection of changes in maize DNA at the shrunken locus due to the intervention of Ds elements, 8:13125 (J:US)
PROTEOLIPIDS
See LIPOPROTEINS
PROTON BEAMS
Polarized Beams
Workshop on acceleration of polarized protons: summary report, 8:12899 (R:US)
PROTON REACTIONS
Capture
$^{27}Al(p,\gamma)^{28}Si$ and $^{27}Al(^3He,d)^{28}Si$ to the stretched 11.58-MeV (6^-,0) and 14.36-MeV (6^-,1) levels, 8:13316 (R:US)
Charge-Exchange Reactions
Charge-exchange 1^+ excitations and precritical phenomena in the atomic nuclei, 8:13304 (RA:SU:In Russian)
Cross Sections
Restriction of the effective number of independent spin channels in a fluctuation analysis, 8:13317 (RA:SU:In Russian)
Elastic Scattering
Algebraic version of resonating-group method and elastic scattering plases of the $^3He(n, n)^3He$, $^3H(p, p)^3H$, $^3H(d, d)^3H$, 8:13299 (RA:SU:In Russian)
Hauser-Feshbach Theory
Restriction of the effective number of independent spin channels in a fluctuation analysis, 8:13317 (RA:SU:In Russian)
Helium 3 Reactions
$^{27}Al(p,\gamma)^{28}Si$ and $^{27}Al(^3He,d)^{28}Si$ to the stretched 11.58-MeV (6^-,0) and 14.36-MeV (6^-,1) levels, 8:13316 (R:US)
Knock-Out Reactions
Neutron yields from the 4-12 MeV proton bombardment of ^{11}B, ^{13}C and $^{18}0$ as related to the production of ^{11}C, ^{13}N and ^{18}f, 8:13314 (J:GB)
Nuclear Data Collections
PNESD proton nucleus elastic scattering data. Contents and documentation, 8:13296 (R:XA)
One-Nucleon Transfer Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Quasi-Elastic Scattering
Momentum spectra in reactions of quasi-elastic knock-out of deuteron, 8:13333 (RA:SU:In Russian)
Research Programs
Nuclear-structure studies using the high-resolution spectrometer at the Los Alamos Clinton P. Anderson Meson Physics Facility. Progress report, 8:13295 (R:US)
Scattering
Algebraic realization of the resonating-group method for multichannel scattering problem in eight nucleons system, 8:13306 (RA:SU:In Russian)
PROTON RECOIL DETECTORS
Energy Dependence
Toward a sub-MeV personnel neutron dosimeter, 8:12984 (RA:US)
Performance
Toward a sub-MeV personnel neutron dosimeter, 8:12984 (RA:US)
PROTON-ANTIPROTON INTERACTIONS
Exchange Interactions
Search for production of narrow p anti p states with a 5 GeV/c p beam, 8:13254 (R:US)
Pair Production
Transverse momentum spectra of dimuons produced in hadronic interactions and comparison with QCD, 8:13259 (R:US)
PROTON-NUCLEON INTERACTIONS
Pair Production
Transverse momentum spectra of dimuons produced in hadronic interactions and comparison with QCD, 8:13259 (R:US)
PSI-3105 RESONANCES
Particle Production
Dimuon production in hadronic interactions, 8:13258 (R:US)
PUBLIC ATTITUDES
See PUBLIC OPINION
PUBLIC BUILDINGS
See also SHOPPING CENTERS
Air Source Heat Pumps
Groundwater-source heat-pump design development: consideration of locally variable factors. Final report, 8:12580 (R:US)
Solar Space Heating
Dwyer Mercer County District Library. Semi-annual technical progress report, 8:12154 (R:US)
Solar Water Heaters
Solar-assisted heat pumps and alternative-energy-awareness demonstration. Final report, 8:12172 (R:US)
Solar-Assisted Heat Pumps
Solar-assisted heat pumps and alternative-energy-awareness demonstration. Final report, 8:12172 (R:US)
Water Source Heat Pumps
Groundwater-source heat-pump design development: consideration of locally variable factors. Final report, 8:12580 (R:US)
PUBLIC OPINION
Surveys
Homeowners survey: gas utilities and the residential solar market, 8:12640 (R:US)
PUBLIC UTILITY REGULATORY POLICIES ACT
PURPA benefits for geothermal power producers: assured markets and regulatory exemptions, 8:12223 (RA:US)
Implementation
PURPA - small power production/cogeneration: implementing problems for the utility, 8:12500 (R:US)
PUERTO RICO
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)

PULMONARY CANCER
See CARCINOMAS
PULMONARY LAVAGE
See LUNGS
PULPS
See SLURRIES
PULVERIZED FUEL ASH
See FLY ASH
PUMPED STORAGE POWER PLANTS
Economic Analysis
Pumped-storage hydroelectric plants with underground lower reservoirs, 8:12450 (R:US)
Environmental Impacts
Pumped-storage hydroelectric plants with underground lower reservoirs, 8:12450 (R:US)
Performance
Pumped-storage hydroelectric plants with underground lower reservoirs, 8:12450 (R:US)
PUMPS
See also WATER PUMPS
Comparative Evaluations
Techno-economic assessment on the utilization of surge-leg pumps in coal liquefaction (For coal slurries), 8:11654 (R:US)
Critical Velocity
Effects of an annular fluid on the critical speed of a rotating shaft, 8:12349 (R:FR)
Failures
Techno-economic assessment on the utilization of surge-leg pumps in coal liquefaction (For coal slurries), 8:11654 (R:US)
Mechanical Vibrations
Effects of an annular fluid on the critical speed of a rotating shaft, 8:12349 (R:FR)
Flow-induced vibration characteristics of the BWR/5-201 jet pump, 8:12292 (R:US)
Vibration monitoring of ebullating pump at the H-Coal pilot plant, 8:11624 (R:US)
Performance Testing
Flow-induced vibration characteristics of the BWR/5-201 jet pump, 8:12292 (R:US)
Technology Assessment
Techno-economic assessment on the utilization of surge-leg pumps in coal liquefaction (For coal slurries), 8:11654 (R:US)
PUREX PROCESS
Radioactive Waste Processing
Removal of solubilized solvent extractants from aqueous waste streams, 8:11919 (J:JP)
PURITY
See IMPURITIES
PURPA
See PUBLIC UTILITY REGULATORY POLICIES ACT
PWR TYPE REACTORS
See also ANGRA-1 REACTOR
ANGRA-2 REACTOR
BIBLIS-A REACTOR
COMANCHE PEAK-1 REACTOR
COMANCHE PEAK-2 REACTOR
DOEL-1 REACTOR
DOEL-2 REACTOR
LOFT REACTOR
LUCIE-1 REACTOR
OBRIGHEIM REACTOR
OTTO HAHN REACTOR
PALISADES-1 REACTOR
SALEM-2 REACTOR
SAN ONOFRE-3 REACTOR
SEQUOYAH-1 REACTOR
SEQUOYAH-2 REACTOR
STADE REACTOR
THREE MILE ISLAND-1 REACTOR
THREE MILE ISLAND-2 REACTOR
TURKEY POINT-3 REACTOR
ZION-2 REACTOR
Alarm Systems
Technical note: handling of alarms using logic, 8:12362 (J:US)
Auxiliary Water Systems
Evaluation of events involving service water systems in nuclear power plants, 8:12295 (R:US)
Blowdown
First comparison of the results of standard problems carried out in the blowdown region, 8:12397 (R:DE:GE)
Containment Buildings
Hydrogen production during fragmented debris/concrete interactions, 8:12419 (R:US)
Containment Systems
CONTEMPT 4/MOD 3: a multicompartment containment system analysis program, 8:12412 (R:US)
Economics
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Fuel Assemblies
Evaluation and demonstration of methods for improved nuclear fuel utilization. Fourth semiannual progress report, July 1 to December 31, 1981, 8:12334 (R:US)
Fuel Cycle
Extended burnup fuel cycle optimization for pressurized water reactors (PUFLAC;DSPWR), 8:12311 (D:US)
Iterative solution to the optimal control of depletion problem in pressurized water reactors, 8:12310 (D:US)
Nuclear-fuel-cycle costs. Consolidated Fuel-Reprocessing Program, 8:11847 (R:US)
Fuel Element Clusters
Experimental investigation of the enthalpy- and mass flow-distribution in 16-rod clusters with BWR-PWR-geometries and conditions. Final report of the ISPRA test-series with the complete data set, 8:12290 (R:XE)
Fuel Pellets
High-burnup PWR ramp test program. Background topical report, Petten ramp test results, 8:12303 (R:US)
In Core Instruments
Synthesis and simulation of corrector filter used for local measurement in PWR core from gamma thermometer signal, 8:12300 (R:FR:In French)
Legal Aspects
Unresolved safety issues summary: aqua book, 8:12405 (R:US)
Loss of Coolant
Calculations for LOFT experiment L3-1 with the homogeneous version of the computer code DRUFAN, 8:12396 (R:DE:GE)
CONTEMPT 4/MOD 3: a multicompartment containment system analysis program, 8:12412 (R:US)
First comparison of the results of standard problems carried out in the blowdown region, 8:12397 (R:DE:GE)
LOCA hydroloads calculations with multidimensional nonlinear fluid/structure interaction. Volume 3. Fluid/structure interaction studies using 3-D STEALTH/WHAMSE. Final report, 8:12390 (R:US)
LOCA simulation in NRU program. Data report for thermal-hydraulic experiment 2 (TH-2), 8:12411 (R:US)
Physical phenomena of a small-break loss-of-coolant accident in a PWR, 8:12423 (J:US)
Meltdown
Analysis of LWR degraded core accidents, 8:12435 (J:US)
Assessment of fuel-foaming potential during core-meltdown accidents, 8:12414 (R:US)
Hydrogen production during fragmented debris/concrete interactions, 8:12419 (R:US)
Operating Cost
Analysis of minimum operational costs for PWR nuclear power plants, 8:12304 (R:BR:In Portuguese)
Pressure Vessels
Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982, 8:12294 (R:US)
The integrity of PWR pressure vessels during overcooling accidents, 8:12439 (J:US)
Reactivity Coefficients
Importance of spatial kinetics in LWR safety analysis, 8:12444 (J:US)
Reactor Accidents
Accident Sequence Evaluation Program, 8:12388 (R:US)
Comprehensive (MORT based) approach to planning internal decontamination, 8:12418 (R:US)

Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents, 8:12413 (R:US)
The integrity of PWR pressure vessels during overcooling accidents, 8:12439 (J:US)
Reactor Components
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)
Reactor Control Systems
Technical note: handling of alarms using logic, 8:12362 (J:US)
Reactor Decommissioning
Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents, 8:12413 (R:US)
Reactor Noise
Third Specialists Meeting on Reactor Noise, 8:12344 (J:US)
Reactor Operation
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)
Operating US power reactors, 8:12297 (J:US)
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Reactor Safety
Unresolved safety issues summary: aqua book, 8:12405 (R:US)
Reactor Shutdown
Events resulting in reactor shutdown and their causes, 8:12426 (J:US)
Steam Generators
Boiling in narrow crevices in steam generators. Final report, 8:12305 (R:US)
Electrochemical behavior of ferrous and ferric ions in EDTA/N_2H_4 solutions, 8:12306 (R:US)
Investigation of on-line chelant addition to PWR steam generators. Annual report, 1981, 8:12302 (R:US)
System Failure Analysis
Analysis of LWR degraded core accidents, 8:12435 (J:US)
PYRENE
Fluorescence Spectroscopy
Fluorescence-line-narrowing spectrometry of polycyclic aromatic hydrocarbons in organic glasses, 8:12755 (R:US)
PYRITE
Chemical Reaction Kinetics
Partial-equilibrium model based on the kinetics of dissolution and equilibrium in solution of the UO_2-FeS_2-$Fe_2(SO_4)_3$-H_2SO_4 system, 8:12823 (R:US)
Dissolution
Partial-equilibrium model based on the kinetics of dissolution and equilibrium in solution of the UO_2-FeS_2-$Fe_2(SO_4)_3$-H_2SO_4 system, 8:12823 (R:US)
Morphology
Petrographic characterization of Kentucky coals. Quarterly progress report, September 1982 - November 1982, 8:11669 (R:US)
Thermoluminescence
Thermoluminescence of the mineral components in granite, 8:13216 (R:US)
PYRITES
See PYRITE
PYROLYSIS PRODUCTS
See also CHARS
Combustion
Gas turbine demonstration of pyrolysis-derived fuels, 8:12080 (RA:US)
Mass Spectra
Fundamental pyrolysis studies, 8:12076 (RA:US)
Pressure Dependence
Peat gasification: low-severity hydropyrolysis, 8:11602 (RA:US)
Temperature Dependence
Peat gasification: low-severity hydropyrolysis, 8:11602 (RA:US)
PYROXYLIN
See NITROCELLULOSE
2-PYRROLIDINECARBOXYLIC ACID
See PROLINE
PYRUVIC ACID
Fermentation
Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms, 8:13135 (BA:US)

Q

QF (RADIATION)
See QUALITY FACTOR
QUADRUPOLE LINACS
Electrodes
Drive for the hf quadrupole structure, 8:12898 (TG:US)
RF Systems
Drive for the hf quadrupole structure, 8:12898 (TG:US)
Specifications
RFQ development at LBL, 8:12896 (R:US)
QUALITY ASSURANCE
Management
Quality assurance for environmental analytical chemistry at Los Alamos, 8:13028 (R:US)
Manuals
Approach to E, S, and H assurance programs for institutions. Volume II. Line-organization functions, 8:12469 (R:US)
QUALITY FACTOR
Calculation Methods
Calculations on neutron dosimetry at the Chalk River Nuclear Laboratory, 8:13397 (RA:US)
QUANTITATIVE CHEMICAL ANALYSIS
X-Ray Diffraction
X-ray powder diffraction system for chemical specification of particulate aerosol samples, 8:12764 (J:NL)
QUANTUM CHROMODYNAMICS
Standard model group, QCD subgroup - dynamics isolating and testing the elementary QCD subprocess, 8:13284 (R:US)
Lattice Field Theory
Why QCD lattice theory is important to spin physicists, 8:13285 (R:US)
Particle Kinematics
Summing logs: the saga continues..... (Summing leading and nonleading logarithms), 8:13288 (R:US)
Perturbation Theory
Summing logs: the saga continues..... (Summing leading and nonleading logarithms), 8:13288 (R:US)
Reviews
Testing quantum chromodynamics, 8:13290 (R:US)
Sum Rules
Research in elementary-particle physics. Progress report, May 1, 1982-April 30, 1983, 8:13250 (R:US)
QUANTUM MECHANICS
Disturbances
Calculations related to quantum stochasticity, an example of overlapping avoided crossings, 8:13412 (J:NL)
QUARK MODEL
CP Invariance
Theoretical studies of high-energy phenomena: analysis of models of CP and T violation. Progress report, May 1, 1981-April 30, 1983, 8:13274 (R:US)
Three-Body Problem
Three-particle relativistic harmonic dynamics in the constraint formalism, 8:13279 (R:JP)
QUARTZ
Radiothermoluminescence
Thermoluminescence of the mineral components in granite, 8:13216 (R:US)
Thermoluminescence
Thermoluminescence of the mineral components in granite, 8:13216 (R:US)
QUASIPARTICLE-PHONON MODEL
Pauli Principle
Taking into account the Pauli principle in description of odd deformed nuclei states, 8:13356 (RA:SU:In Russian)

QUINOLINES
Hydrogenation
New catalysts for coal-liquid upgrading. Quarterly report, September 1-December 31, 1982, 8:11637 (R:US)
Phosphorescence
Solid-surface luminescence analysis. Progress report, June 1980-October 1982, 8:12804 (R:US)

R

RA 333
See ALLOY-RA-333
RACIAL GROUPS
See MINORITY GROUPS
RADAPPERTIZATION
See RADIOSTERILIZATION
RADIATION ACCIDENTS
Emergency Plans
Joint research and development on toxic-material emergency response between ENEA and LLNL. 1982 progress report, 8:13196 (R:US)
Environmental Impacts
Accident-generated aerosols: assessment methodology (Review of methods for estimating quantity and characteristics of accident-generated aerosols), 8:13031 (R:US)
Radiation Monitoring
Capabilities of the Los Alamos National Laboratory's environmental emergency-response vehicle, 8:13042 (R:US)
Therapy
1976 Hanford americium exposure incident: medical management and chelation therapy, 8:13143 (R:US)
RADIATION BURDEN
See RADIATION DOSES
RADIATION CHEMISTRY
Research Programs
Nature of oxygen-containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, July 1981-June 1982, 8:12820 (R:US)
Radiation-induced effects in organic systems. Final report, 8:12819 (R:US)
Report of activity, 8:12471 (R:FR:FR)
RADIATION DECONTAMINATION
See DECONTAMINATION
RADIATION DETECTORS
See also CHERENKOV COUNTERS
DIELECTRIC TRACK DETECTORS
GEIGER-MUELLER COUNTERS
IONIZATION CHAMBERS
LOW LEVEL COUNTERS
NEUTRON DETECTORS
PHOTOGRAPHIC FILM DETECTORS
POSITION SENSITIVE DETECTORS
PROPORTIONAL COUNTERS
SCINTILLATION COUNTERS
SEMICONDUCTOR DETECTORS
SHOWER COUNTERS
Meetings
Current trends in personnel and environmental monitoring, 8:12963 (R:DE:GE)
Statistics
Basic statistics for nuclear electronics, 8:12949 (R:XE:In Italian)
Target Chambers
Vacuum pipe for e^+e^- interactions, 8:12933 (R:US)
Vacuum Systems
Vacuum pipe for e^+e^- interactions, 8:12933 (R:US)
RADIATION DOSEMETERS
See DOSEMETERS
RADIATION DOSES
Calculation Methods
Dose to basal cells in bronchial epithelium from long-lived alpha emitters in uranium mines, 8:13171 (BA:US)
Measuring Methods
New tasks and techniques in the measurement of high radiation doses, 8:12951 (RA:DE:In German)
RADIATION DOSIMETRY
See DOSIMETRY
RADIATION EXPOSURE (DOSES)
See RADIATION DOSES
RADIATION HYGIENE
See RADIATION PROTECTION
RADIATION MONITORING
See also PERSONNEL MONITORING
Sampling
Pitfalls in air sampling for radioactive particulates, 8:13049 (BA:US)
RADIATION MONITORS
See also EXPOSURE RATEMETERS
NEUTRON MONITORS
Capabilities of the Los Alamos National Laboratory's environmental emergency-response vehicle, 8:13042 (R:US)
Health physics instruments: what are the current needs, 8:12994 (R:US)
Calibration
Experience in the calibration of contamination monitors, 8:12962 (RA:DE:In German)
RADIATION PROTECTION
Health physics instruments: what are the current needs, 8:12994 (R:US)
Optimization
Analysis of a proposed one thousand dollar per man-rem cost-effectiveness criterion, 8:12416 (R:US)
Organizational Models
Organizational measures to be taken to enable the official dose records offices to meet the requirements of legislation, 8:13390 (RA:DE:In German)
Recommendations
Present state of 'Arbeitskreis Dosismessung' - recommendation on environmental monitoring, 8:13381 (RA:DE:In German)
RADIATION SAFETY
See RADIATION PROTECTION
RADIATION SOURCES
For cosmic sources of radiation see also COSMIC GAMMA SOURCES, COSMIC RADIO SOURCES, and COSMIC X-RAY SOURCES.
See also LIGHT SOURCES
SYNCHROTRON RADIATION SOURCES
Production
Cesium glass irradiation sources, 8:11947 (R:US)
RADIATION STREAMING
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R:US)
RADIATORS
Limited to heat radiators.
Specifications
Conceptual designs for 100-MW space radiators, 8:12322 (R:US)
RADICALS
Not to be used for compound descriptions.
See also HYDROPEROXY RADICALS
HYDROXYL RADICALS
SUPEROXIDE RADICALS
Chemical Reaction Kinetics
Kinetic and mechanistic studies of the reactions of selected aliphatic radicals with metal complexes and the decomposition of organoperoxy cobalt complexes ($C(CH_3)_2OH$ and $CH(CH_3)OC_2H_5$ radicals), 8:12788 (R:US)
Kinetics and mechanisms of the reactions of aliphatic free radicals with organocobaloximes and fluoropentaamminecobalt(III) ion, and of iron(III) with methylrhodoxime ($C(CH_3)_2OH$ and $C(CH_3)OC_2H_5$ radicals), 8:12789 (R:US)
Laser Spectroscopy
Laser spectroscopy of combustion intermediates (Cyano radical cations), 8:12829 (R:US)
RADIOACTIVE AEROSOLS
Air Pollution Control
Survey of HEPA filter experience, 8:13046 (R:US)
Ecological Concentration
Use of air sampling data from uranium mills to estimate respiratory tract deposition rates for inhaled yellowcake, 8:11929 (RA:US)

Inhalation
Two-year dose pattern studies of inhaled yellowcake in the Beagle dog, 8:13155 (RA:US)
Use of air sampling data from uranium mills to estimate respiratory tract deposition rates for inhaled yellowcake, 8:11929 (RA:US)
Particle Size
Use of air sampling data from uranium mills to estimate respiratory tract deposition rates for inhaled yellowcake, 8:11929 (RA:US)

RADIOACTIVE BIOLOGICAL WASTES
See RADIOACTIVE WASTES

RADIOACTIVE EFFLUENTS
Radiation Monitoring
Pitfalls in air sampling for radioactive particulates, 8:13049 (BA:US)
Sampling
Pitfalls in air sampling for radioactive particulates, 8:13049 (BA:US)

RADIOACTIVE GASEOUS WASTES
See GASEOUS WASTES
RADIOACTIVE WASTES

RADIOACTIVE MATERIALS
See also FISSION PRODUCTS
RADIOACTIVE WASTES
Metallography
Metallograph for the examination of low-level radioactive samples, 8:11948 (J:US)
Remote Handling
Breeder reactor program T-3 cask, 8:12445 (J:US)
T-3 cask handling systems at HFEF, 8:12446 (J:US)
Remote Handling Equipment
Bag-out material-handling system (Patent), 8:12861 (P:US)
Design guides for radioactive material handling facilities and equipment, 8:12862 (J:US)
Transport
RADTRAN II: revised computer code to analyze transportation of radioactive material (Code predicts radiological impacts), 8:11852 (R:US)
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)

RADIOACTIVE PARTICULATES
See RADIOACTIVE AEROSOLS

RADIOACTIVE TRACERS
See RADIOPHARMACEUTICALS
TRACER TECHNIQUES

RADIOACTIVE WASTE DISPOSAL
ONWI library reports list, 8:11892 (R:US)
Alpha-Bearing Wastes
Comparative assessment of disposal of TRU waste in a greater-confinement disposal facility, 8:11873 (R:US)
Technical progress report for the quarter, 1 October-31 December, 1981, 8:11894 (R:US)
Technical progress report for the quarter, 1 July-30 September 1981, 8:11893 (R:US)
Geologic Deposits
Annotated bibliography for the design of waste packages for geologic disposal of spent fuel and high-level waste, 8:11895 (R:US)
Formulation of an integrated physicochemical-hydrologic model for predicting waste-nuclide retardation in geologic media, 8:11909 (R:US)
Hydrogeology of radioactive waste isolation: the challenge of a rational assessment, 8:11918 (J:US)
Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments, 8:12687 (R:US)
Proceedings of the international seminar on chemistry and process engineering for high-level liquid waste solidification, 8:11888 (R:DE:In German and English)
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Technical progress report for the quarter, 1 October-31 December, 1981, 8:11894 (R:US)
Technical progress report for the quarter, 1 July-30 September 1981, 8:11893 (R:US)
Geology
Hydrogeology of radioactive waste isolation: the challenge of a rational assessment, 8:11918 (J:US)
Heat Transfer
Influence of convective-energy transfer on calculated temperature distributions in proposed hard-rock nuclear waste repositories, 8:11917 (J:US)
High-Level Radioactive Wastes
Analysis of waste-package behavior for high-level waste, 8:11910 (R:US)
Annotated bibliography for the design of waste packages for geologic disposal of spent fuel and high-level waste, 8:11895 (R:US)
Commercial nuclear-waste research and development program. Quarterly report, July-September 1982, 8:11874 (R:US)
Commercial nuclear waste research and development program. Annual report, fiscal year 1982, 8:11875 (R:US)
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Hydrogeology of radioactive waste isolation: the challenge of a rational assessment, 8:11918 (J:US)
In situ and laboratory geotechnical test results from borehole GD-1 in southeast Utah, 8:11897 (R:US)
Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments, 8:12687 (R:US)
Parameters and variables appearing in repository-siting models, 8:11891 (R:US)
Proceedings of the international seminar on chemistry and process engineering for high-level liquid waste solidification, 8:11888 (R:DE:In German and English)
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Subseabed Disposal Program. Annual report, January-September 1981. Volume I: summary, 8:11908 (R:US)
Technical progress report for the quarter, 1 October-31 December, 1981, 8:11894 (R:US)
Technical progress report for the quarter, 1 July-30 September 1981, 8:11893 (R:US)
Hydrology
Hydrogeology of radioactive waste isolation: the challenge of a rational assessment, 8:11918 (J:US)
Krypton 85
Nuclear-waste management semiannual progress report, April 1982-September 1982, 8:11899 (R:US)
Low-Level Radioactive Wastes
Directions in low-level radioactive-waste management, 8:11868 (R:US)
Incentives and compensation: providing resources for communities hosting low-level waste facilities, 8:11870 (RA:US)
Low-level radioactive waste disposal: commercial facilities no longer operating, 8:11871 (RA:US)
Planning state policy on low-level radioactive waste, 8:11869 (RA:US)
Potential role of biotic transport models in low-level-waste management (Shallow land burial), 8:11901 (R:US)
Waste classification system for low-level radioactive wastes, 8:11882 (R:US)
Marine Disposal
Department of Energy ocean-disposal programs: complements to land-based disposal, 8:11911 (R:US)
Seventh International NEA/Seabed Working Group Meeting, 8:11907 (R:US)
Subseabed Disposal Program. Annual report, January-September 1981. Volume I: summary, 8:11908 (R:US)
Materials Testing
Container assessment: corrosion study of HLW container materials. Quarterly progress report, January-March 1982, 8:12686 (R:US)
Mill Tailings
Consolidation theory and its applicability to the dewatering and covering of uranium-mill tailings, 8:11924 (R:US)

Handbook for the design, selection, and construction of a rock cover for retired uranium-mill tailings, 8:11902 (R:US)
Multidimensional simulation of radon diffusion through earthen covers, 8:11922 (R:US)
Remedial actions at inactive uranium mill tailings sites, 8:11920 (BA:US)
Packaging
Annotated bibliography for the design of waste packages for geologic disposal of spent fuel and high-level waste, 8:11895 (R:US)
Radionuclide Migration
Analysis of waste-package behavior for high-level waste, 8:11910 (R:US)
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
FECWASTE: user's manual of a Finite-Element Code for simulating WASTE transport through saturated-unsaturated porous media. Environmental Sciences Division Publication No. 1907, 8:11926 (R:US)
Formulation of an integrated physicochemical-hydrologic model for predicting waste-nuclide retardation in geologic media, 8:11909 (R:US)
Potential role of biotic transport models in low-level-waste management (Shallow land burial), 8:11901 (R:US)
Research Programs
Commercial nuclear-waste research and development program. Quarterly report, July-September 1982, 8:11874 (R:US)
Commercial nuclear waste research and development program. Annual report, fiscal year 1982, 8:11875 (R:US)
Results of research and development works 1981 of the Institute for Nuclear Waste Management Techniques, 8:11889 (R:DE:In German)
Technical progress report for the quarter, 1 October-31 December, 1981, 8:11894 (R:US)
Technical progress report for the quarter, 1 July-30 September 1981, 8:11893 (R:US)
Risk Assessment
Hydrogeology of radioactive waste isolation: the challenge of a rational assessment, 8:11918 (J:US)
Proceedings of the international seminar on chemistry and process engineering for high-level liquid waste solidification, 8:11888 (R:DE:In German and English)
Salt Deposits
In situ and laboratory geotechnical test results from borehole GD-1 in southeast Utah, 8:11897 (R:US)
Technical progress report for the quarter, 1 October-31 December, 1981, 8:11894 (R:US)
Technical progress report for the quarter, 1 July-30 September 1981, 8:11893 (R:US)
Seismic Effects
Impact of seismicity on the stability of an underground repository, 8:11906 (R:US)
Site Selection
Incentives and compensation: providing resources for communities hosting low-level waste facilities, 8:11870 (RA:US)
Parameters and variables appearing in repository-siting models, 8:11891 (R:US)
Reconnaissance seismic refraction studies at Calico Hills, Wahmonie, and Yucca Mountain: southwest Nevada Test Site, Nye County, Nevada, 8:13214 (R:US)
Spent Fuels
Annotated bibliography for the design of waste packages for geologic disposal of spent fuel and high-level waste, 8:11895 (R:US)
Temperature Distribution
Influence of convective-energy transfer on calculated temperature distributions in proposed hard-rock nuclear waste repositories, 8:11917 (J:US)
Underground Disposal
Potential role of biotic transport models in low-level-waste management (Shallow land burial), 8:11901 (R:US)
Waste-Rock Interactions
Release kinetics and alteration of waste glass in crystalline rock systems, 8:11915 (J:NL)

RADIOACTIVE WASTE FACILITIES
Design
Conceptual design of monitored retrievable storage facilities, 8:11859 (J:US)
Equipment
Guidebook for reliability, availability, and maintainability analysis of NWTS repository equipment. Volume II. Appendices, 8:11896 (R:US)
Seismic Effects
Impact of seismicity on the stability of an underground repository, 8:11906 (R:US)
Site Selection
Incentives and compensation: providing resources for communities hosting low-level waste facilities, 8:11870 (RA:US)
Parameters and variables appearing in repository-siting models, 8:11891 (R:US)
RADIOACTIVE WASTE MANAGEMENT
ONWI library reports list, 8:11892 (R:US)
Waste management at LAMPF, 8:11914 (J:US)
Alpha-Bearing Wastes
Plutonium fuel fabrication residues and wastes, 8:11865 (R:FR)
Gaseous Wastes
Nuclear-waste management semiannual progress report, April 1982-September 1982, 8:11899 (R:US)
High-Level Radioactive Wastes
Nuclear-waste management semiannual progress report, April 1982-September 1982, 8:11899 (R:US)
Low-Level Radioactive Wastes
Directions in low-level radioactive-waste management, 8:11868 (R:US)
Incentives and compensation: providing resources for communities hosting low-level waste facilities, 8:11870 (RA:US)
Low-level radioactive waste disposal: commercial facilities no longer operating, 8:11871 (RA:US)
Nuclear-waste management semiannual progress report, April 1982-September 1982, 8:11899 (R:US)
Planning state policy on low-level radioactive waste, 8:11869 (RA:US)
Planning
Objectives for radioactive waste packaging, 8:11863 (R:GB)
Research Programs
Nuclear-waste management semiannual progress report, April 1982-September 1982, 8:11899 (R:US)
RADIOACTIVE WASTE PROCESSING
Feasibility of vitrifying EPICOR II organic resins, 8:12394 (R:US)
ONWI library reports list, 8:11892 (R:US)
Alpha-Bearing Wastes
SRL incinerator components test facility, 8:11876 (R:US)
Combustion
Pilot solid-waste incinerator, 8:11877 (R:US)
Radioactive-waste incineration at Purdue University, 8:11872 (R:US)
SRL incinerator components test facility, 8:11876 (R:US)
Distillation
Pt. 3. Acid separation, 8:11886 (RA:XE:In German)
High-Level Radioactive Wastes
Characterization of borosilicate glass containing Savannah River Plant radioactive waste, 8:11878 (R:US)
Nuclear-waste management semiannual progress report, April 1982-September 1982, 8:11899 (R:US)
Proceedings of the international seminar on chemistry and process engineering for high-level liquid waste solidification, 8:11888 (R:DE:In German and English)
Ion Exchange
Recycle of iodine-loaded silver mordenite by hydrogen reduction, 8:11900 (R:US)
Thermal stability of ion-exchange resins, 8:11912 (R:SE)
Liquid Wastes
Removal of solubilized solvent extractants from aqueous waste streams, 8:11919 (J:JP)
Low-Level Radioactive Wastes
Radioactive-waste incineration at Purdue University, 8:11872 (R:US)

Research and disposition of highly loaded organic resins, 8:11883 (R:US)
Meetings
Proceedings of the international seminar on chemistry and process engineering for high-level liquid waste solidification, 8:11888 (R:DE:In German and English)
Plutonium
Pt. 1: Dissolution of plutonium oxide during the process, 8:11884 (RA:XE:In German)
Pt. 2: Non-active laboratory for demonstrating the ILONA process. Construction and operating results, 8:11885 (RA:XE:In German)
Pt. 3. Acid separation, 8:11886 (RA:XE:In German)
Wet combustion of plutonium-containing wastes, 8:11887 (R:DE:GE)
Research Programs
Pelletized waste form demonstration program, April-September 1982, 8:11890 (R:US)
Solidification
Characterization of borosilicate glass containing Savannah River Plant radioactive waste, 8:11878 (R:US)
Nuclear-waste management semiannual progress report, April 1982-September 1982, 8:11899 (R:US)
Pelletized waste form demonstration program, April-September 1982, 8:11890 (R:US)
Proceedings of the international seminar on chemistry and process engineering for high-level liquid waste solidification, 8:11888 (R:DE:In German and English)
Research and disposition of highly loaded organic resins, 8:11883 (R:US)
Theoretical predictions for continuous-slurry feeding of a glass melter, 8:11879 (R:US)
Thermal stability of ion-exchange resins, 8:11912 (R:SE)
Vitrification
French status of high level radioactive wastes solidification, 8:11864 (R:FR)
Wet Ashing
Pt. 1: Dissolution of plutonium oxide during the process, 8:11884 (RA:XE:In German)
Pt. 2: Non-active laboratory for demonstrating the ILONA process. Construction and operating results, 8:11885 (RA:XE:In German)
Pt. 3. Acid separation, 8:11886 (RA:XE:In German)
Wet combustion of plutonium-containing wastes, 8:11887 (R:DE:GE)

RADIOACTIVE WASTE STORAGE
Economic Analysis
Economics of monitored retrievable storage of nuclear wastes, 8:11858 (J:US)
High-Level Radioactive Wastes
Background and historical perspectives for monitored retrievable storage, 8:11856 (J:US)
Conceptual design of monitored retrievable storage facilities, 8:11859 (J:US)
Economics of monitored retrievable storage of nuclear wastes, 8:11858 (J:US)
Overview of the Monitored Retrievable Storage (MRS) program, 8:11904 (R:US)
Savannah River Plant waste-tank inspection manual, 8:11881 (R:US)
Screening for monitored retrievable storage facility locations, 8:11857 (J:US)
Planning
Overview of the Monitored Retrievable Storage (MRS) program, 8:11904 (R:US)
Site Selection
Screening for monitored retrievable storage facility locations, 8:11857 (J:US)
Tanks
Savannah River Plant waste-tank inspection manual, 8:11881 (R:US)
Underground Storage
Savannah River Plant waste-tank inspection manual, 8:11881 (R:US)

RADIOACTIVE WASTES
See also ALPHA-BEARING WASTES
CALCINED WASTES
HIGH-LEVEL RADIOACTIVE WASTES
LOW-LEVEL RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
Chemical Properties
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
Leaching
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Transport
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
Transport Regulations
DOT's proposed routing for radioactive material shipments, 8:12858 (J:US)
Vitrification
Cesium glass irradiation sources, 8:11947 (R:US)

RADIOAPPLICATORS
See RADIATION SOURCES

RADIODIAGNOSIS (RADIONUCLIDES)
See NUCLEAR MEDICINE

RADIOISOTOPE HEAT SOURCES
Strontium-90 and promethium-147 recovery, 8:11951 (R:US)
Capsules
Surface studies of iridium-alloy grain boundaries associated with weld cracking, 8:11949 (R:US)
Cost
Additional Pu-238 production, 8:11952 (R:US)
Radioisotopes for heat-source applications, 8:11953 (R:US)
Fabrication
^{238}Pu fuel form processes. Quarterly report, April-June 1982, 8:11950 (R:US)
Research Programs
^{238}Pu fuel form processes. Quarterly report, April-June 1982, 8:11950 (R:US)

RADIOISOTOPE KINETICS
See RADIONUCLIDE KINETICS

RADIOISOTOPE MIGRATION
See RADIONUCLIDE MIGRATION

RADIOISOTOPE-LABELLED DRUGS
See RADIOPHARMACEUTICALS

RADIOISOTOPES
Four-Pi Counting
Activity determination by a 4π-γ well-type ionization chamber, 8:12967 (R:BR)
Meetings
Proceedings of the 1977 joint annual convention, Radioisotope Society of the Phillippines Inc., and the Philippine Society for Nuclear Medicine, 8:11945 (R:PH)
Production
Design characteristics of a cyclotron for producing radioisotopes, 8:12827 (TG:DE:GE)

RADIOLOGICAL PERSONNEL
Behavior
1976 Hanford americium exposure incident: psychological aspects, 8:13144 (R:US)

RADIOLOGICAL PROTECTION
See RADIATION PROTECTION

RADIONUCLIDE DISTRIBUTIONS
See RADIONUCLIDE KINETICS

RADIONUCLIDE KINETICS
For radionuclides in living organisms only; see also TRANSLOCATION.
Mathematical Models
Retention of ^{226}Ra in human soft tissue and bone; implications for the ICRP 20 alkaline earth model, 8:13166 (J:GB)

RADIONUCLIDE METABOLISM
See RADIONUCLIDE KINETICS

RADIONUCLIDE MIGRATION
In environment.
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Mathematical Models
FECWASTE: user's manual of a Finite-Element Code for simulating WASTE transport through saturated-unsaturated

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Formulation of an integrated physicochemical-hydrologic model for predicting waste-nuclide retardation in geologic media, 8:11909 (R:US)
Mathematical simulation of sediment and radionuclide transport in estuaries, 8:13089 (R:US)
Measurements and modeling of gamma absorbed doses due to releases from a linear proton accelerator: experimental design and preliminary results, 8:13043 (R:US)
Models of the distribution of ^{210}Pb in a section across the North Equatorial Atlantic Ocean, 8:13093 (J:US)
Texas Panhandle soil-crop-beef food chain for uranium: a dynamic model validated by experimental data, 8:13065 (R:US)

Research Programs
Contaminant migration and fate research at Pacific Northwest Laboratory, 8:13045 (R:US)

RADIONUCLIDE TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION

RADIONUCLIDE TRANSFER (IN ORGANISMS)
See RADIONUCLIDE KINETICS

RADIONUCLIDE TURNOVER
See RADIONUCLIDE KINETICS

RADIONUCLIDES
See RADIOISOTOPES

RADIOPHARMACEUTICALS

Chemical Preparation
Nuclear medicine progress report for quarter ending September 30, 1982, 8:13131 (R:US)

Design
Design and evaluation of radiotracers for determination of regional cerebral blood flow with PET, 8:13129 (R:US)

RADIOPHOTOLUMINESCENT DOSEMETERS
See RPL DOSEMETERS

RADIOSTERILIZATION

Bibliographies
Bibliography of the Beneficial Uses/Sewage-Sludge-Irradiation Project, 1974-1982, 8:13157 (R:US)

RADIOSURGERY
See RADIOTHERAPY

RADIOTHERAPY

Accelerator Facilities
Advanced medical accelerator design, 8:12925 (R:US)

RADIOWAVE RADIATION

Biological Effects
Health implications of exposure to radiofrequency/microwave energies, 8:13195 (J:GB)

RADIUM

Precipitation
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)

Solubility
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)

RADIUM 213

Alpha Decay
Simplified and semisimplified α-decay of N=125 nuclei and effective nucleon-nucleon interaction, 8:13345 (RA:SU:In Russian)

RADIUM 226

Radioecological Concentration
Intake of ^{226}Ra by ingestion and its evaluation in a selected population group, 8:13095 (TJ:US)

Retention
Retention of ^{226}Ra in human soft tissue and bone; implications for the ICRP 20 alkaline earth model, 8:13166 (J:GB)

RADIUM D
See LEAD 210

RADON

Diffusion
Multidimensional simulation of radon diffusion through earthen covers, 8:11922 (R:US)

Radiation Monitoring
Evaluation of experiences in long-term radon and radon-daughter measurements, 8:13044 (R:US)

RADON 211

Alpha Decay
Simplified and semisimplified α-decay of N=125 nuclei and effective nucleon-nucleon interaction, 8:13345 (RA:SU:In Russian)

RADON 222

Monitoring
Radon and radon-daughter exposure measurements by through-etched track registration in cellulose nitrate, 8:12944 (R:BR)

RADON 226

Radioecological Concentration
Models of the distribution of ^{210}Pb in a section across the North Equatorial Atlantic Ocean, 8:13093 (J:US)

RAILWAYS

Capacity
Moving coal by rail (USA; forecasting), 8:11744 (RA:US)

Investment
Moving coal by rail (USA; forecasting), 8:11744 (RA:US)

RANGELANDS

Temperature Effects
Research issues in grazing lands under changing climate. Volume 12, Part 16. Environmental and societal consequences of a possible CO_2-induced climate change, 8:13061 (R:US)

RAPID TRANSIT SYSTEMS

Energy Consumption
BART's energy consumption and costs: a comparative analysis, 8:12599 (RA:US)

Operating Cost
BART's energy consumption and costs: a comparative analysis, 8:12599 (RA:US)

RARE EARTH ALLOYS
See also LANTHANUM ALLOYS
PRASEODYMIUM ALLOYS

Phase Diagrams
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RARE EARTH COMPOUNDS
See also GADOLINIUM COMPOUNDS
MONAZITES
NEODYMIUM COMPOUNDS

Magnetic Properties
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)

Superconductivity
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)

RARE EARTH NUCLEI
For nuclear properties of rare earths.
See also CERIUM 141
CERIUM 143
CERIUM 148
ERBIUM 156
EUROPIUM 147
EUROPIUM 149
EUROPIUM 153
EUROPIUM 155
EUROPIUM 157
EUROPIUM 159
LANTHANUM 140
LANTHANUM 142
LANTHANUM 146
LANTHANUM 148
PRASEODYMIUM 142
PRASEODYMIUM 148
PROMETHIUM 144
PROMETHIUM 147
THULIUM 167
THULIUM 169
THULIUM 171
YTTERBIUM 169

Energy Levels
States of negative parity in even-even nuclei, 8:13353 (RA:SU:In Russian)

RARE EARTHS
See also CERIUM
DYSPROSIUM
ERBIUM
EUROPIUM
GADOLINIUM
HOLMIUM
LANTHANUM

LUTETIUM
NEODYMIUM
PRASEODYMIUM
SAMARIUM
TERBIUM
THULIUM
YTTERBIUM

Research Programs
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RARE GASES
See also ARGON
RADON
XENON

Phase Transformations
High-resolution x-ray scattering, 8:12913 (R:US)

X-Ray Diffraction
High-resolution x-ray scattering, 8:12913 (R:US)

RATEMETERS (EXPOSURE)
See EXPOSURE RATEMETERS

RATS

Radionuclide Kinetics
Comparison of infrared analysis and in vitro dissolution results with clearance of inhaled uranium in rats exposed to yellowcake aerosols, 8:13154 (RA:US)
Retention and translocation of uranium following subcutaneous implantation in rats of yellowcake powder from two uranium mills, 8:13153 (RA:US)

RDF
See REFUSE DERIVED FUELS

REACTION INTERMEDIATES

Chemical Reaction Kinetics
Preparation and characterization of ligand types intermediate in the metal catalyzed conversion of coal to methane, methanol, and higher alkanes and alcohols. Final progress report, September 1, 1978-June 30, 1982 (Transitional metal-formyl complexes; hydroxymethylidene complexes; metal α-hydroxyalkyl complexes; alkidene complexes), 8:11598 (R:US)

REACTIVITY COEFFICIENTS

Calculation Methods
Importance of spatial kinetics in LWR safety analysis, 8:12444 (J:US)

REACTOR ACCIDENTS
See also LOSS OF COOLANT
MELTDOWN
REACTOR CORE DISRUPTION
Incidents in German nuclear power stations, 8:12447 (TG:GB)

Decontamination
Comprehensive (MORT based) approach to planning internal decontamination (PWR;BWR), 8:12418 (R:US)
Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents, 8:12413 (R:US)

Emergency Plans
Emergency planning: life protection or ALARA, 8:12431 (J:US)

Evaluation
Impact of source term assumptions on reactor accident consequences, 8:12430 (J:US)

Experiment Planning
Degraded core studies at INEL, 8:12434 (J:US)

Failure Mode Analysis
Accident Sequence Evaluation Program, 8:12388 (R:US)

Fission Product Release
Investigation of the influence of modified parameters in the atmospheric dispersion model on the results of the German Risk Study (DRS), 8:13040 (R:DE:In German)

Heat Transfer
Formation of dry pockets during water penetration into a hot particle bed, 8:12436 (J:US)

Hydraulics
Formation of dry pockets during water penetration into a hot particle bed, 8:12436 (J:US)

Pressure Gradients
BWR 4/Mark I accident sequences assessment, 8:12415 (R:US)

Radiation Hazards
Impact of source term assumptions on reactor accident consequences, 8:12430 (J:US)

Risk Assessment
Investigation of the influence of modified parameters in the atmospheric dispersion model on the results of the German Risk Study (DRS), 8:13040 (R:DE:In German)

Standardized Terminology
Impact of source term assumptions on reactor accident consequences, 8:12430 (J:US)

Temperature Gradients
BWR 4/Mark I accident sequences assessment, 8:12415 (R:US)

Thermal Stresses
The integrity of PWR pressure vessels during overcooling accidents, 8:12439 (J:US)

REACTOR CELLS

M Codes
Multigroup program for calculating the thermal neutron utilization factor in multizone cylindrical reactor cell (MGPRAKTINETs), 8:12340 (R:SU:In Russian)

Neutron Flux
Multigroup program for calculating the thermal neutron utilization factor in multizone cylindrical reactor cell (MGPRAKTINETs), 8:12340 (R:SU:In Russian)

REACTOR COMPONENTS
See also BREEDING BLANKETS
CONTROL ELEMENTS
FUEL ELEMENTS
REACTOR CORES

Failures
Incorporation of various uncertainties in dependent failure probability estimation, 8:12433 (J:US)

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Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)

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Applications of energy release rate techniques to part-through cracks in plates and cylinders. Volume 1. ORMGEN-3D: a finite element mesh generator for 3-dimensional crack geometries, 8:12353 (R:US)
Stress analysis for nuclear power plant components, 8:12355 (R:BR)

REACTOR CONTROL RODS
See CONTROL ELEMENTS

REACTOR CONTROL SYSTEMS
Technical note: handling of alarms using logic, 8:12362 (J:US)

REACTOR CONTROL THEORY
See REACTOR KINETICS

REACTOR CORE DISRUPTION

Simulation
Heat, mass, and momentum transfer from large two-phase bubbles (UVABUBL), 8:12320 (D:US)

REACTOR CORES

Heat Transfer
Formation of dry pockets during water penetration into a hot particle bed, 8:12436 (J:US)

Hydraulics
Formation of dry pockets during water penetration into a hot particle bed, 8:12436 (J:US)

Meltdown
Degraded core aspects of Sandia's probabilistic and cost-benefits programs, 8:12437 (J:US)

REACTOR DECOMMISSIONING

Cost
Funding nuclear-power-plant decommissioning. Final report, 8:12336 (R:US)
Technology, safety and costs of decommissioning reference light-water reactors following postulated accidents, 8:12413 (R:US)

Financing
Funding nuclear-power-plant decommissioning. Final report, 8:12336 (R:US)

REACTOR FUEL ELEMENTS
See FUEL ELEMENTS

REACTOR FUELS
See NUCLEAR FUELS

REACTOR KINETICS

Neutron Diffusion Equation
Notes on multigroup diffusion kinetics, 8:12343 (R:BR)

Numerical Analysis
Nodal analysis for reactor kinetics and stability, 8:12348 (D:US)

REACTOR KINETICS EQUATIONS
Gamma Transport Theory
Raffle V general purpose Monte Carlo code for neutron and gamma transport, 8:12339 (R:US)
Monte Carlo Method
Raffle V general purpose Monte Carlo code for neutron and gamma transport, 8:12339 (R:US)
Neutron Transport Theory
Raffle V general purpose Monte Carlo code for neutron and gamma transport, 8:12339 (R:US)
Numerical Solution
Notes on multigroup diffusion kinetics, 8:12343 (R:BR)

REACTOR LATTICES
Computer Calculations
Integral transport multiregion geometrical shadowing factor for the approximate collision probability matrix calculation of infinite closely packed lattices, 8:12347 (D:US)
Transport Theory
Integral transport multiregion geometrical shadowing factor for the approximate collision probability matrix calculation of infinite closely packed lattices, 8:12347 (D:US)

REACTOR LICENSING
Licensing procedure for construction and operation of nuclear power plants, 8:12324 (R:BR:In Portuguese)

REACTOR MATERIALS
To be assigned in conjunction with the specific descriptor for the material used in a reactor, provided this descriptor is not yet up-posted to reactor materials.
See also NUCLEAR FUELS
Quantitative Chemical Analysis
Determination of carbon in sodium by the distillation-combustion method, 8:12319 (R:IN)

REACTOR NOISE
Meetings
Third Specialists Meeting on Reactor Noise, 8:12344 (J:US)

REACTOR OPERATORS
Health Hazards
Allowable shipment frequencies for the transport of toxic gases near nuclear power plants, 8:13184 (R:US)

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Use only for indexing articles of very broad coverage, such as annual reviews, text book, etc.
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R:US)
Nuclear Data Collections
ENDF/B fission-product data, 8:13321 (R:US)
Research Programs
Results of research and development work 1981 of the Institute for Neutron Physics and Reactor Engineering, 8:12287 (R:DE:In German)

REACTOR SAFETY
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R:US)
General administrative activities, 8:12428 (J:US)
Validation of real-time software for nuclear-plant-safety applications. Final report, 8:12391 (R:US)
Budgets
ACRS review of the 1983 NRC Safety Research Program, 8:12421 (J:US)
Data Acquisition Systems
NRC/DAE reactor safety research Data Bank, 8:12387 (R:US)
Document Types
Reports, standards, and safety guides, 8:12429 (J:US)
Measuring Methods
Development and application of a methodology for the analysis of significant human related event trends in nuclear power plants, 8:12441 (D:US)
Research Programs
ACRS review of the 1983 NRC Safety Research Program, 8:12421 (J:US)
DOE plans for LWR safety research, 8:12422 (J:US)
NRC/DAE reactor safety research Data Bank, 8:12387 (R:US)
Results of research and development work 1981 of the Institute for Neutron Physics and Reactor Engineering, 8:12287 (R:DE:In German)
Results of research and development activities in 1981 of the Institute for Reactor Components, 8:12403 (R:DE:In German)
Selected review of foreign safety research for nuclear power plants, 8:12417 (R:US)

REACTOR SITES
Site Selection
Role of regulatory body related to siting, 8:12365 (R:CA)

REACTOR STABILITY
Numerical Analysis
Nodal analysis for reactor kinetics and stability, 8:12348 (D:US)

REACTOR START-UP
Simulation
Insertion of control systems models in the Almod 3 computer code for the simulation of Angra I reactor start-up tests, 8:12301 (R:BR:In Portuguese)

RECEIVERS (SOLAR)
See SOLAR RECEIVERS

RECOMBINATION (GENETIC)
See GENE RECOMBINATION

RECOVERY (TRITIUM)
See TRITIUM RECOVERY

RECYCLE (FUEL)
See FUEL CYCLE

REFRACTORIES
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
Materials Testing
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)

REFRIGERANTS
Vapor Condensation
Condensation of Refrigerant-11 on the outside of horizontal and inclined enhanced tubes, 8:12241 (R:US)

REFUELING WATER SYSTEMS
See AUXILIARY WATER SYSTEMS

REFUSE
See SOLID WASTES

REFUSE DERIVED FUELS
Combustion
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Energy recovery for Kent and Sussex Counties, Delaware: Phase II study report, 8:12629 (R:US)
Tacoma refuse-fired combustor feasibility study, 8:12627 (R:US)
Compacting
Tacoma refuse-fired combustor feasibility study, 8:12627 (R:US)
Tacoma refuse-fired combustor study. Phase II. (RDF densification study), 8:12628 (R:US)
Gasification
Tacoma refuse-fired combustor feasibility study, 8:12627 (R:US)
Tacoma refuse-fired combustor study. Phase II. (RDF densification study), 8:12628 (R:US)
Materials Handling
A field test using DRDF in a spreader stoker hot water generator. Final report Sep 80-Jul 81, 8:12891 (R:US)
Production
Demonstration of landfill gas-enhancement techniques in landfill simulators, 8:11959 (R:US)
Energy recovery for Kent and Sussex Counties, Delaware: Phase II study report, 8:12629 (R:US)
Solid Wastes
A field test using DRDF in a spreader stoker hot water generator. Final report Sep 80-Jul 81, 8:12891 (R:US)

REFUSE-FUELED BOILERS
Co-utilization of municipal solid waste and wood residues for small-scale resource recovery: a preliminary assessment, 8:12637 (R:US)
Environmental Effects
A field test using DRDF in a spreader stoker hot water generator. Final report Sep 80-Jul 81, 8:12891 (R:US)
Feasibility Studies
Fluidized-bed retofit study of C-E VUX-type boiler at the Jamestown Board of Public Utilities Carlson Station, Jamestown, New York, 8:12623 (R:US)
Performance
A field test using DRDF in a spreader stoker hot water generator. Final report Sep 80-Jul 81, 8:12891 (R:US)
Performance Testing
Tacoma refuse-fired combustor study. Phase II. (RDF densification study), 8:12628 (R:US)
REFUSE-FUELED POWER PLANTS
Co-utilization of municipal solid waste and wood residues for small-scale resource recovery: a preliminary assessment, 8:12637 (R:US)
Financing
Nashville Electric Service cogeneration energy-recovery facility, 8:12626 (R:US)
Legal Aspects
Nashville Electric Service cogeneration energy-recovery facility, 8:12626 (R:US)
Political Aspects
Nashville Electric Service cogeneration energy-recovery facility, 8:12626 (R:US)
REGION X
See FEDERAL REGION X
REGOLITH
See OVERBURDEN
REGRESSION ANALYSIS
Algorithms
Least absolute deviations regression, 8:13414 (R:US)
REINFORCED MATERIALS
Fibers
Problems and solutions in using short fiber reinforcements, 8:12721 (BA:US)
RELEASE (FISSION PRODUCT)
See FISSION PRODUCT RELEASE
REM
See DOSE EQUIVALENTS
REMOTE CONTROL
Human Factors Engineering
Human factors in Remote-Control-Engineering Task development activities. Consolidated Fuel-Reprocessing Program, 8:11820 (R:US)
REMOTE HANDLING
Remote handling features of the fusion materials irradiation test (FMIT) facility, 8:13532 (J:US)
Remote systems requirements for tandem-mirror fusion power reactors, 8:13531 (J:US)
Replacement of large torus shield sectors in ETF with remote techniques, 8:13529 (J:US)
Tandem mirror next step-remote maintenance, 8:13530 (J:US)
REMOTE HANDLING EQUIPMENT
See also MANIPULATORS
Design guides for radioactive material handling facilities and equipment, 8:12862 (J:US)
Remote-handling demonstration tests for the Fusion Materials Irradiation Test (FMIT) Facility, 8:13482 (R:US)
Three equipment concepts for the Fusion Engineering Device, 8:13465 (R:US)
Design
Bag-out material-handling system (Patent), 8:12861 (P:US)
Metallography
Metallograph for the examination of low-level radioactive samples, 8:11948 (J:US)
Monitors
Monitors 1980: now there are two, 8:12443 (J:US)
Operation
Bag-out material-handling system (Patent), 8:12861 (P:US)
Test Facilities
Remote-Systems Demonstration Facility. Consolidated Fuel-Reprocessing Program, 8:12839 (R:US)
REMOTE VIEWING EQUIPMENT
Test Facilities
Remote-Systems Demonstration Facility. Consolidated Fuel-Reprocessing Program, 8:12839 (R:US)
REMOVAL (AFTER-HEAT)
See AFTER-HEAT REMOVAL
RENEWABLE ENERGY SOURCES
See also BIOMASS
GEOTHERMAL ENERGY
HYDROELECTRIC POWER
SOLAR ENERGY
WIND POWER
Climate and energy, 8:12001 (RA:CH)
Constraints
Texas Energy Development Fund. Volume I. Perspectives for RD & D, 8:12511 (R:US)
Financing
Financing conservation and renewable energy in the eighties, 8:12548 (R:US)
Fuel Cycle
Comparing the health and environmental hazards of different energy systems, 8:13100 (R:US)
Research Programs
Texas Energy Development Fund. Volume II. Administration plan, 8:12512 (R:US)
REPAIR (BIOLOGICAL)
See BIOLOGICAL REPAIR
REPUBLIC OF CHINA
See TAIWAN
REPUBLIC OF KOREA
Energy Consumption
Fuel-cell technology assessment. Volume V. Evaluation of South Korea, 8:12530 (R:US)
Power Generation
Fuel-cell technology assessment. Volume V. Evaluation of South Korea, 8:12530 (R:US)
RESEARCH AND TEST REACTORS
See also RESEARCH REACTORS
Burnup
Fuel management modeling with REBUS-2 for research and test reactors, 8:12376 (J:US)
Fuel Management
Fuel management modeling with REBUS-2 for research and test reactors, 8:12376 (J:US)
Research Programs
U.S. reduced enrichment research and test reactor (RERTR) program: accomplishments, plans, and schedules, 8:12371 (J:US)
RESEARCH PROGRAMS
To be used jointly with descriptor(s) for subject field and/or organization concerned.
See also COORDINATED RESEARCH PROGRAMS
Advisory Committees
Guiding R and D policy, 8:12473 (J:US)
RESEARCH REACTORS
See also FFTF REACTOR
HPRR REACTOR
Burnable Poisons
Analytical comparison of Boron and cadmium absorbers in research reactors, 8:12374 (J:US)
Burnup
Burnup-dependent cross-section data for research reactors and a comparision of REBUS-2 and PDQ-7 Burnup, 8:12377 (J:US)
Fuel Elements
Comparative performance of a 10-MW generic reactor with HEU and LEU fuels, 8:12373 (J:US)
Fuel Plates
Status of development of high-uranium density reduced-enrichment plate-type fuels, 8:12372 (J:US)
Neutron Flux
Comparative performance of a 10-MW generic reactor with HEU and LEU fuels, 8:12373 (J:US)
Neutronic performance of a 14-MW TRIGA reactor LEU vs HEU Fuel, 8:12375 (J:US)

Reactor Shutdown
Events resulting in reactor shutdown and their causes, 8:12426 (J:US)
RESERVOIR ENGINEERING
Conceptual aspects of subsidence due to fluid withdrawal, 8:13201 (J:US)
RESERVOIR ROCK
Fractures
Assessing the permeability characteristics of fractured rock, 8:13203 (J:US)
Ground Subsidence
Conceptual aspects of subsidence due to fluid withdrawal, 8:13201 (J:US)
Plugging
Prediction of chemical problems in the reinjection of geothermal brines, 8:12238 (J:US)
RESIDENCES
See HOUSES
RESIDENTIAL BUILDINGS
See also HOUSES
Air Conditioners
Development of a method to improve the efficiency of commercial and residential air-conditioning systems. Final report, 8:12574 (R:US)
Passive Solar Heating Systems
Fast correlation method for passive-solar design, 8:12161 (R:US)
Thermal Insulation
In-situ study of attic loose-fill thermal insulation in residential application, 8:12558 (R:US)
RESIDENTIAL SECTOR
Energy Conservation
Assessment of energy conservation opportunities in state-assisted housing, 8:12478 (R:US)
Energy Consumption
Michigan energy futures: requirements to the year 2000, 8:12482 (R:US)
Energy Expenses
Technology assessment of solar energy systems. Socioeconomic impacts of solar deployment and conventional energy use. Volume III, 8:12020 (R:US)
Solar Heating Systems
Technology assessment of solar energy systems. Socioeconomic impacts of solar deployment and conventional energy use. Volume III, 8:12020 (R:US)
RESIDUAL FUEL OIL
See RESIDUAL FUELS
RESIDUAL FUELS
Steam Reformer Processes
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)
RESIDUAL HEAT REMOVAL
See RHR SYSTEMS
RESIDUES
See also ASHES
Recycling
Exxon donor solvent coal liquefaction process: ECLP operating experience II, 8:11592 (RA:US)
RESIDUES (RADIOACTIVE)
See RADIOACTIVE WASTES
RESIDUUMS
See RESIDUAL FUELS
RESISTORS
Calibration
Improving divider calibration techniques, 8:12888 (R:US)
RESONANCE
See also GIANT RESONANCE
Fermi Gas Model
Usage of the sum rules for a systematics of the analog and Gamow-Teller resonances in the self-consistent theory of the finite Fermi systems, 8:13358 (RA:SU:In Russian)
RESONANCE CAVITIES
See CAVITY RESONATORS
RESONANCE NEUTRONS
Transmission
Method for analysis of averages over transmission energy of resonance neutrons, 8:13376 (RA:SU:In Russian)
RESOURCE ASSESSMENT
Interior's minerals-management programs need consolidation to improve accountability and control, 8:12488 (R:US)
RESOURCE DEVELOPMENT
Constraints
Special requirements and procedures for geothermal development on Navy lands, 8:12226 (RA:US)
Environmental Impacts
Environmental data requirements and analysis for development of peat program, 8:11688 (RA:US)
RESOURCE RECOVERY FACILITIES
Economic Analysis
Energy recovery for Kent and Sussex Counties, Delaware: Phase II study report, 8:12629 (R:US)
Environmental Impacts
Energy recovery for Kent and Sussex Counties, Delaware: Phase II study report, 8:12629 (R:US)
Surveys
State of California: resource-recovery profile, 8:12634 (R:US)
RESPIRATORY SYSTEM DISEASES
Diagnostic Techniques
Pulmonary function and /sup 81m/Kr scans in obstructive pulmonary disease, 8:13133 (J:GB)
REVERSE-FIELD PINCH
Adiabatic Compression Heating
Adiabatic compression of elongated field-reversed configurations, 8:13442 (R:US)
Energy Losses
Classical transport coefficients in a field-reversed configuration, 8:13458 (J:GB)
Equilibrium Plasma
Adiabatic compression of elongated field-reversed configurations, 8:13442 (R:US)
Mathematical Models
Zero-dimensional model for field-reversed configurations, 8:13440 (R:US)
Plasma Confinement
FRC confinement studies in FRX-C, 8:13441 (R:US)
Velocity-space particle loss in field-reversed configurations, 8:13419 (R:US)
Zero-dimensional model for field-reversed configurations, 8:13440 (R:US)
Reviews
The status of reversed-field pinch experiments, 8:13456 (J:US)
Thermonuclear Ignition
Burn dynamic experiment based on the field-reversed theta pinch, 8:13466 (R:US)
RHENIUM
Activation Energy
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
Catalytic Effects
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
RHEOLOGY
Fluid Mechanics
Rheology via nonequilibrium molecular dynamics, 8:13409 (R:US)
Thermodynamics
Rheology via nonequilibrium molecular dynamics, 8:13409 (R:US)
RHINE RIVER
Radiation Monitoring
Plutonium contamination of the 'Altrhein' river, 8:13088 (R:DE:In German)
RHO-765 RESONANCES
Particle Production
Double Regge exchange in rho $\Delta\pi$ and rho rho N final states from π^- p interactions at 8 GeV/c, 8:13257 (R:US)
RHODAMINES
Fluorescence
Dynamic aspects of the dye-sensitized photoconductivity of semiconductors. Technical progress report, April 1, 1981-March 31, 1983, 8:12733 (R:US)

RHODE ISLAND
Geological Surveys
State resource estimation: Rhode Island, 8:11699 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Peat resource estimation in Rhode Island, 8:11713 (RA:US)
State resource estimation: Rhode Island, 8:11699 (RA:US)
Resource Assessment
State resource estimation: Rhode Island, 8:11699 (RA:US)
RHODIUM
Crystallography
LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R:US)
Sorptive Properties
LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R:US)
Surface Properties
LEED crystallography studies of the structure of clean and adsorbate-covered Ir, Pt and Rh crystal surfaces, 8:12685 (R:US)
RHODIUM 103 TARGET
Neutron Reactions
Fast-neutron total and scattering cross sections of ^{103}Rh, 8:13319 (R:US)
RHODIUM BORIDES
Magnetic Properties
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)
Superconductivity
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)
RHR SYSTEMS
Failures
Analysis of hypothetical accidents in fast breeder reactors. Part III. Supplementary analysis of coolant disruption for Mark 1A burned-up core of the SNR-300 with the SAS 3D computer program, 8:12395 (R:DE:GE)
RIBBON-TO-RIBBON METHOD
Exploratory development of thin-film polycrystalline-silicon photovoltaic devices. Final technical report, 8:12098 (R:US)
RICHLAND FFTF REACTOR
See FFTF REACTOR
RIDESHARING
See VANPOOLING
RINGOTRON
See ELECTRON-RING ACCELERATORS
RISER CRACKING
See COAL LIQUEFACTION
RISK ASSESSMENT
Comparing the health and environmental hazards of different energy systems, 8:13100 (R:US)
ROBOTS
Seven technologies for the eighties, 8:12470 (R:US)
ROCK DRILLING
Research Programs
Geothermal technology development program. Annual progress report, October 1980-September 1981, 8:12247 (R:US)
ROCK SALT
See SALT DEPOSITS
ROCKS
See also SEDIMENTARY ROCKS
SYNTHETIC ROCKS
Permeability
Ground-water problems in open-pit and underground mines, 8:11740 (J:US)
Phase Transformations
Overburden characterization and post-burn study of the Hoe Creek, Wyoming underground coal gasification site and comparison with the Hanna, Wyoming site, 8:11622 (R:US)
Precipitation
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Radionuclide Migration
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Solubility
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
ROCKWELL FLASH HYDROLIEUEFACTION PROCESS
See CS-R PROCESS
ROCKWELL INTERNATIONAL PROCESS
See MOLTEN SALT COAL GASIFICATION PROCESS
ROCKY MOUNTAIN OVERTHRUST BELT
See WESTERN US OVERTHRUST BELT
RODS (CONTROL)
See CONTROL ELEMENTS
RODS (FUEL)
See FUEL RODS
ROENTGEN EQUIVALENT MAN
See DOSE EQUIVALENTS
ROOF BOLTS
Installation
One-inch flexible drill for resin bolter module. Final technical report, Phases I and II, September 30, 1977-April 30, 1981, 8:12845 (R:US)
RPL DOSEMETERS
Comparative Evaluations
Results of an inquiry concerning experience gained in the use of thermoluminescent and phosphate glass dosemeters, 8:12952 (RA:DE:In German)
RTR METHOD
See RIBBON-TO-RIBBON METHOD
RUBBER INDUSTRY
Energy Conservation
Energy utilization in tire manufacturing. Final report, 8:12619 (R:US)
RUBBERS
Activation Analysis
Simultaneous determination of antimony and chlorine in synthetic rubbers by 14 MeV neutron activation analysis, 8:12765 (J:CH)
RUBIDIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Solvent Extraction
Metal-ion complexation by ionic-crown ethers. Progress report 8:12803 (R:US)
RUPTURES
Effects of triaxial stressing on creep cavitation of grain boundaries, 8:13402 (R:US)
RURAL AREAS
Photovoltaic Power Supplies
Worldwide market for photovoltaics in the rural sector, 8:12015 (R:US)
Sensitivity
Regional assessment of potential sensitivity of soils in the eastern United States to acid precipitation, 8:13062 (R:US)
RUTHENIUM
Activation Energy
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
Catalytic Effects
Hydrogenation of carbon monoxide over ruthenium-rhenium on alumina catalysts, 8:11652 (R:US)
Sorptive Properties
H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R:US)
RUTHENIUM BORIDES
Magnetic Properties
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)
Superconductivity
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)

RUTHENIUM COMPLEXES
Chemical Reactions
Studies of hydrogenation of small unsaturated molecules using organometallic cluster compounds as catalysts. Progress report, June 1, 1982-May 31, 1983, 8:12802 (R:US)
Infrared Spectra
Isotope effects in the infrared spectra of the metal carbonyl hydride/deuteride anions $(H/D)M(CO)_4^-$ (M = Fe, Ru, or Os), 8:12798 (J:US)
Molecular Structure
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R:US)
Monoclinic Lattices
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R:US)
Triclinic Lattices
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R:US)
RWE-BAYERNWERK REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)

S

S PROCESS
Excited States
Population probabilities of excited states in radioactive nuclei for s-process studies, 8:13229 (R:DE)
SACCHAROMYCES CEREVISIAE
Genetic Engineering
Development of high alcohol tolerant organisms. I. Strain selection and screening. Annual report, 31 July 1981-1 August 1982, 8:11973 (R:US)
Radiosensitivity
Ligase-deficient yeast cells exhibit defective DNA rejoining and enhanced gamma ray sensitivity, 8:13160 (J:US)
SACLAY SYNCHROTRON
See SATURNE
SAFEGUARDS
See also IAEA SAFEGUARDS
Classified Information
Control of information as an element of nuclear safeguards, 8:11942 (R:US)
Data Base Management
International safeguards data management system, 8:11934 (R:XE)
International safeguards data-management system, 8:11935 (R:XE)
SAFETY
For general aspects of safety and protection of personnel.
See also OCCUPATIONAL SAFETY
REACTOR SAFETY
Quality Assurance
Approach to E, S, and H assurance programs for institutions. Volume II. Line-organization functions, 8:12469 (R:US)
SAFETY (NUCLEAR)
See RADIATION PROTECTION
SAFETY (REACTOR)
See REACTOR SAFETY
SAFETY STANDARDS
Canada
Proposed statement on safety objectives for nuclear activities in Canada, 8:12327 (R:CA)
SALEM NUCLEAR GENERATING STATION UNIT-2
See SALEM-2 REACTOR
SALEM-2 REACTOR
Reactor Operation
Selected safety-related events reported in May and June 1982, 8:12427 (J:US)
Reactor Safety
Selected safety-related events reported in May and June 1982, 8:12427 (J:US)
SALINE ZONE
See OIL SHALES
SALT DEPOSITS
Compression Strength
In situ and laboratory geotechnical test results from borehole GD-1 in southeast Utah, 8:11897 (R:US)
Creep
In situ and laboratory geotechnical test results from borehole GD-1 in southeast Utah, 8:11897 (R:US)
Strains
In situ and laboratory geotechnical test results from borehole GD-1 in southeast Utah, 8:11897 (R:US)
Stresses
In situ and laboratory geotechnical test results from borehole GD-1 in southeast Utah, 8:11897 (R:US)
SAMARIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
SAN ONOFRE-3 REACTOR
Reactor Licensing
Technical specifications: San Onofre Nuclear Generating Station, Unit No. 3, Docket No. 50-362. Appendix A to license No. NPF-15, 8:12308 (R:US)
Specifications
Technical specifications: San Onofre Nuclear Generating Station, Unit No. 3, Docket No. 50-362. Appendix A to license No. NPF-15, 8:12308 (R:US)
SANDSTONES
Geologic History
Approximation of continuity of lenticular Mesaverde sandstone lenses, utilizing close-well correlations, Piceance Basin, northwest, Colorado. Western Gas Sands Project, 8:11817 (R:US)
Leaching
Investigation of the inaccessible pore volume phenomena, 8:11804 (J:US)
Porosity
Investigation of the inaccessible pore volume phenomena, 8:11804 (J:US)
Stratigraphy
Approximation of continuity of lenticular Mesaverde sandstone lenses, utilizing close-well correlations, Piceance Basin, northwest, Colorado. Western Gas Sands Project, 8:11817 (R:US)
SANITARY LANDFILLS
Computerized Simulation
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Fuel Gas
Development of the utilization of combustible gas produced in existing sanitary landfills: investigation of effects of air inclusion, 8:12630 (R:US)
Leachates
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Liners
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Monitoring
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Recommendations
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Site Selection
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
SATURNE
Polarized Beams
Workshop on acceleration of polarized protons: summary report, 8:12899 (R:US)

SAUDI ARABIA
Dual-Purpose Power Plants
Reliability and system analysis of nuclear desalination plants based on operation experience, 8:12288 (D:US)
SAVANNAH RIVER
Radioactivity
Interpretation of low-level environmental radioactivity measurements, 8:13038 (R:US)
SAVANNAH RIVER PLANT
Computer Networks
Savannah River Laboratory local area computer network, 8:13547 (R:US)
Environmental Effects
Stack-released plutonium in the terrestrial environment of a chemical separations facility, 8:13067 (J:US)
Radiation Monitoring
Interpretation of low-level environmental radioactivity measurements, 8:13038 (R:US)
SCANDIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Magnetic Susceptibility
Magnetic susceptibility of scandium-hydrogen and lutetium-hydrogen solid-solution alloys from 2 to 300°K, 8:12681 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
SCANDIUM COMPOUNDS
See also SCANDIUM HYDRIDES
Structural Chemical Analysis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
Synthesis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
SCANDIUM HYDRIDES
Magnetic Susceptibility
Magnetic susceptibility of scandium-hydrogen and lutetium-hydrogen solid-solution alloys from 2 to 300°K, 8:12681 (R:US)
Nuclear Magnetic Resonance
Spin-lattice relaxation of protons in scandium dihydride, 8:12713 (R:US)
SCATTERING
Calculation Methods
Analysis of neutron room return, 8:13398 (RA:US)
SCHNELLER NATRIUMGEKUEHLTER REAKTOR
See SNR-1 REACTOR
SCHOOL BUILDINGS
Solar Space Heating
Corona del Sol High School solar system, Tempe Union High School District No. 213. Final technical report (Engineering Materials), 8:12174 (E:US)
Solar Water Heating
Corona del Sol High School solar system, Tempe Union High School District No. 213. Final technical report (Engineering Materials), 8:12174 (E:US)
SCHOOL FACILITIES
See EDUCATIONAL FACILITIES
SCHOOL PLANT
See EDUCATIONAL FACILITIES
SCINTILLATION CHAMBERS
See SCINTILLATION COUNTERS
SCINTILLATION COUNTERS
Trigger Circuits
Versatile secondary trigger for a multi-detector system, 8:12993 (R:US)
SCINTILLATION DETECTORS
See SCINTILLATION COUNTERS
SCLERA
See EYES
SCRAPERS
Testing
Tests of cryogenic pigs for use in liquefied gas pipelines, 8:11821 (R:US)
SCRUBBERS
See also DRY SCRUBBERS
Energy Consumption
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)
Sludges
Chemical and physical characterization of western low-rank-coal waste materials. Part 3. Sludges from wet scrubbers using fly ash as a scrubbing reagent. Final report, 8:11683 (R:US)
Waste Water
IGT U-GAS pilot plant scrubber effluent analysis, 8:11682 (R:US)
SEA BED
Corrosive Effects
Corrosion rates and evaluations of structural materials on the North Atlantic Continental Rise, 8:12683 (R:US)
Meetings
Seventh International NEA/Seabed Working Group Meeting, 8:11907 (R:US)
SEAWATER
Chemical Analysis
Increase of total CO_2 in the world oceans. Annual progress report, 8:13081 (R:US)
Corrosive Effects
Corrosion rates and evaluations of structural materials on the North Atlantic Continental Rise, 8:12683 (R:US)
Radiochemical Analysis
Am-241/Pu-239 + 240 ratios in the marine environment, 8:13094 (J:GB)
Radionuclide Migration
Integrative study of the behavior of transuranic elements in the marine environment. Progress report, June 1, 1982-May 31, 1983, 8:13083 (R:US)
SEBACEOUS GLANDS
See SKIN
SECONDARY BATTERIES
See ELECTRIC BATTERIES
SECONDARY RECOVERY
See ENHANCED RECOVERY
SEDIMENTARY ROCKS
See also CARBONATE ROCKS
SANDSTONES
SHALES
Petrogenesis
Preliminary investigation of accessory zircons from volcanic and sedimentary rocks from Clear Lake, 8:12253 (RA:US)
SEDIMENTS
Chemical Analysis
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Geochemical Surveys
Evaluation of uranium geochemical anomalies in the Charlotte 1° x 2° NTMS quadrangle, 8:11829 (R:US)
Geochemistry
Mercury in the sediments of Clear Lake, 8:12214 (RA:US)
Pollen
Late Pleistocene stratigraphy and palynology of Clear Lake, 8:12194 (RA:US)
Radionuclide Migration
Mathematical simulation of sediment and radionuclide transport in estuaries, 8:13089 (R:US)
Sediment and radionuclide transport in rivers: radionuclide transport modeling for Cattaraugus and Buttermilk Creeks, New York, 8:13090 (R:US)

Stratigraphy
Late Pleistocene stratigraphy and palynology of Clear Lake, 8:12194 (RA:US)

SEISMIC DETECTION
Energy and technology review, 8:11663 (R:US)

SEISMIC DETECTORS
Performance Testing
Regional seismic test network, 8:13017 (RA:US)

SELENIUM
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Precipitation
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Solubility
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)

SEMICONDUCTOR COUNTERS
See SEMICONDUCTOR DETECTORS

SEMICONDUCTOR DETECTORS
See also GE SEMICONDUCTOR DETECTORS
HGI2 SEMICONDUCTOR DETECTORS
SI SEMICONDUCTOR DETECTORS
SURFACE BARRIER DETECTORS
Performance
Bismuth germanate as a high-energy gamma-ray detector, 8:12971 (R:US)

SEMICONDUCTOR DEVICES
See also SEMICONDUCTOR DIODES
SEMICONDUCTOR STORAGE DEVICES
Superlattices
Ga(As,P) strained-layer superlattices: a ternary semiconductor with independently adjustable band gap and lattice constant, 8:12886 (R:US)

SEMICONDUCTOR DIODES
See also PHOTODIODES
SILICON DIODES
Impurities
Measurement techniques for high-power semiconductor materials and devices. Annual report, October 1, 1980-December 31, 1981, 8:12885 (R:US)

SEMICONDUCTOR MATERIALS
If possible index also the specific compounds.
Activation Analysis
Determination of uranium and thorium in semiconductor memory materials by high fluence neutron activation analysis, 8:12766 (J:CH)
Carrier Lifetime
Measurement techniques for high-power semiconductor materials and devices. Annual report, October 1, 1980-December 31, 1981, 8:12885 (R:US)
Photoconductivity
Dynamic aspects of the dye-sensitized photoconductivity of semiconductors. Technical progress report, April 1, 1981-March 31, 1983, 8:12733 (R:US)
Traps
Measurement techniques for high-power semiconductor materials and devices. Annual report, October 1, 1980-December 31, 1981, 8:12885 (R:US)

SEMICONDUCTOR STORAGE DEVICES
Electronic Circuits
Applying the MRV11-C board, 8:13552 (R:US)

SENIOR CENTERS
See PUBLIC BUILDINGS

SEPARATION NOZZLE METHOD
Autoradiolysis
Importance of radiolytic decomposition of uranium hexafluoride in the course of uranium-235 enrichment under the separation nozzle method, 8:11843 (R:DE:In German)

SEQUOYAH NUCLEAR POWER PLANT UNIT-1
See SEQUOYAH-1 REACTOR

SEQUOYAH NUCLEAR POWER PLANT UNIT-2
See SEQUOYAH-2 REACTOR

SEQUOYAH-1 REACTOR
Containment Systems
Safety evaluation report related to the operation of Sequoyah Nuclear Plant, Units 1 and 2, Docket Nos. 50-327 and 50-328, Tennessee Valley Authority, 8:12404 (R:US)
Reactor Accidents
Safety evaluation report related to the operation of Sequoyah Nuclear Plant, Units 1 and 2, Docket Nos. 50-327 and 50-328, Tennessee Valley Authority, 8:12404 (R:US)

SEQUOYAH-2 REACTOR
Containment Systems
Safety evaluation report related to the operation of Sequoyah Nuclear Plant, Units 1 and 2, Docket Nos. 50-327 and 50-328, Tennessee Valley Authority, 8:12404 (R:US)
Reactor Accidents
Safety evaluation report related to the operation of Sequoyah Nuclear Plant, Units 1 and 2, Docket Nos. 50-327 and 50-328, Tennessee Valley Authority, 8:12404 (R:US)

SERVICE WATER SYSTEMS
See AUXILIARY WATER SYSTEMS

SEWAGE
See also SEWAGE SLUDGE
Radiation Monitoring
On-line liquid-effluent monitoring of sewage at Lawrence Livermore National Laboratory, 8:13092 (R:US)

SEWAGE SLUDGE
Anaerobic Digestion
Fuel cell cogeneration in the wastewater treatment industry, 8:12543 (BA:US)
Radiosterilization
Bibliography of the Beneficial Uses/Sewage-Sludge-Irradiation Project, 1974-1982, 8:13157 (R:US)

SHALE OIL
Chemical Analysis
Laser excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons, 8:12758 (R:US)
Chemical Reaction Yield
Synthetic fuels from US oil shales: a technical and economic verification of the HYTORT process. Final report (incorporates fourth quarterly report), January 1-March 31, 1981, 8:11825 (R:US)

SHALES
See also ARGILLITE
Stratigraphy
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)

SHEARER LOADERS
Manufacturers
Longwall data bank. Quarterly project status report, August 28-November 28, 1982 and semiannual report No. 3, 8:11731 (R:US)

SHEATHS (FUEL)
See FUEL CANS

SHELL GASIFICATION PROCESS
Flowsheets
Shell coal gasification process, 8:11585 (RA:US)
Pilot Plants
Shell coal gasification process, 8:11585 (RA:US)
Process Development Units
Shell coal gasification process, 8:11585 (RA:US)

SHELLS
Structural forms; for electron shells in atoms use ELECTRONIC STRUCTURE.
Deformation
Buckling investigation of ring-stiffened cylindrical shells under unsymmetrical axial loads, 8:12352 (R:US)
Finite Element Method
Finite element for plates and shells, 8:12853 (R:BR:In Portuguese)

SHELLS (CONTAINMENT)
See CONTAINMENT SHELLS

SHF RADIATION
See RADIOWAVE RADIATION

SHIELDING
Erosion
Graphite limiter and armor damage in Doublet III, 8:13476 (R:US)
Sputtering
Graphite limiter and armor damage in Doublet III, 8:13476 (R:US)
SHIELDING MATERIALS
Fabrication
Neutron-shielding material. Translated from the Japanese, 8:13374 (R:US)
Photon Beams
Attenuation of photon beams from radionuclides. Pt. 6, 8:13373 (R:DE:In German)
SHIELDS
Remote Handling
Replacement of large torus shield sectors in ETF with remote techniques, 8:13529 (J:US)
SHIPS
See also TANKER SHIPS
Fuel Consumption
Least-energy operation of river shipping, 8:12588 (RA:US)
SHOPPING CENTERS
Photovoltaic Power Supplies
Intermediate photovoltaic system application experiment operational performance report. Volume 14. For Lovington Square Shopping Center, Lovington, New Mexico, July and August 1982, 8:12114 (R:US)
SHORT-LENS SPECTROMETERS
See MAGNETIC LENS SPECTROMETERS
SHOTFIRING
See EXPLOSIVE FRACTURING
SHOWER COUNTERS
Detects high energy gamma radiation or high energy particles on basis of cascade showers in layered absorbers.
Calorimeters
Measurements of radial and longitudinal hadron shower development at 300 GeV, 8:12999 (J:NL)
Design
Annual progress report for the high-energy-physics program at Texas A and M University, December 1, 1981-December 1, 1982, 8:12947 (R:US)
SHOWERS
Effect of the crystal structure of the medium on the evolution of the electromagnetic shower, 8:13262 (RA:SU:In Russian)
SI SEMICONDUCTOR DETECTORS
See also LI-DRIFTED SI DETECTORS
Charge Collection
Charge collection in silicon strip detectors, 8:12943 (R:US)
Spatial Resolution
Charge collection in silicon strip detectors, 8:12943 (R:US)
SIALON
See ALUMINIUM OXIDES
SILICON NITRIDES
SILANES
Magnetic Resonance
Magnetic-resonance studies of reactively sputtered amorphous silicon-hydrogen alloys, 8:12739 (R:US)
Photoconductivity
Drift mobilities by time-of-flight methods and time-dependent phototransport in the nanosecond regime in amorphous semiconductors, 8:12734 (R:US)
Structural Chemical Analysis
Magnetic-resonance studies of reactively sputtered amorphous silicon-hydrogen alloys, 8:12739 (R:US)
SILICA
Catalytic Effects
Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R:US)
Surface Properties
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R:US)
SILICA GEL
Sorptive Properties
Correlation of petroleum component properties for caustic flooding, 8:12772 (J:US)
SILICATES
Catalytic Effects
Method for the preparation of a gaseous fuel, 8:11991 (TG:GB)
SILICON
Bioassay
Applications of nuclear technologies for in-vivo elemental analysis, 8:13059 (R:US)
Carrier Lifetime
Measurement techniques for high-power semiconductor materials and devices. Annual report, October 1, 1980-December 31, 1981, 8:12885 (R:US)
Chemical Vapor Deposition
Process of deposition of silicon single-crystal bars directly from the vapour phase, 8:12060 (R:LU)
Crystal Defects
Process of deposition of silicon single-crystal bars directly from the vapour phase, 8:12060 (R:LU)
Semicrystalline casting process development and verification. Quarterly progress report No. 7, December 19, 1981-March 19, 1982, 8:12044 (R:US)
Crystal Doping
Low-cost solar-array project: cell and module formation research area. Process research of non-CZ silicon material. Quarterly report No. 3, September 1, November 30, 1982, 8:12050 (R:US)
Cutting
Semicrystalline casting process development and verification. Quarterly progress report No. 7, December 19, 1981-March 19, 1982, 8:12044 (R:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Masking
Low-cost solar-array project: cell and module formation research area. Process research of non-CZ silicon material. Quarterly report No. 3, September 1, November 30, 1982, 8:12050 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Mathematical Models
Semicrystalline casting process development and verification. Quarterly progress report No. 7, December 19, 1981-March 19, 1982, 8:12044 (R:US)
Production
Exploratory development of thin-film polycrystalline-silicon photovoltaic devices. Final technical report, 8:12098 (R:US)
Traps
Measurement techniques for high-power semiconductor materials and devices. Annual report, October 1, 1980-December 31, 1981, 8:12885 (R:US)
SILICON 28
Energy Levels
$^{27}Al(p,\gamma)^{28}Si$ and $^{27}Al(^3He,d)^{28}Si$ to the stretched 11.58-MeV (6^-,0) and 14.36-MeV (6^-,1) levels, 8:13316 (R:US)
Nuclear Radii
Surface waves in α-nuclei elastic scattering, 8:13303 (R:IT)
SILICON 28 TARGET
Alpha Reactions
Surface waves in α-nuclei elastic scattering, 8:13303 (R:IT)
Proton Reactions
Restriction of the effective number of independent spin channels in a fluctuation analysis, 8:13317 (RA:SU:In Russian)
SILICON ALLOYS
See also ALLOY-HK-40
ALLOY-RA-333
Explosive Forming
Microstructural modification of aluminum-silicon alloy powders during dynamic consolidation, 8:12691 (R:US)

Moessbauer Effect
Moessbauer-effect studies of crystalline and amorphous iron-based alloys and of corrosion processes at iron surfaces, 8:12675 (R:US)

SILICON CARBIDES
Fabrication
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)

SILICON DIODES
Energy Dependence
Personnel neutron dosimeters based on organic polymers, 8:12978 (RA:US)

SILICON HYDRIDES
See SILANES

SILICON NITRIDES
Explosive Forming
Densification kinetics of shock-activated nitrides, 8:12715 (R:US)
Fracture Properties
Fracture of hot-pressed silicon nitride at elevated temperatures, 8:12706 (R:US)

SILICON OXIDES
See also QUARTZ
SILICA
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
Ionic Conductivity
NMR in doped monocrystals of superionic conductor β-$LiAlSiO_4$ (β-eukryptite), 8:12698 (J:CH:In German)

SILICON SEMICONDUCTOR DETECTORS
See SI SEMICONDUCTOR DETECTORS

SILICON SOLAR CELLS
Electric Contacts
Competitive investigations of oxidation processes for silicon MIS-solar cells. Final report, 8:12058 (R:XE)
Development of metallization process, FSA project, cell and module formation research area. Quarterly technical report for the period ending September 30, 1982, 8:12049 (R:US)
Semicrystalline casting process development and verification. Quarterly progress report No. 7, December 19, 1981-March 19, 1982, 8:12044 (R:US)
Fabrication
Exploratory development of thin-film polycrystalline-silicon photovoltaic devices. Final technical report, 8:12098 (R:US)
Low-cost solar-array project: cell and module formation research area. Process research of non-CZ silicon material. Quarterly report No. 3, September 1, November 30, 1982, 8:12050 (R:US)
Failures
Electrical overstress failure in silicon solar cells, 8:12086 (R:US)
Oxidation
Competitive investigations of oxidation processes for silicon MIS-solar cells. Final report, 8:12058 (R:XE)
Performance
Low-cost solar-array project: cell and module formation research area. Process research of non-CZ silicon material. Quarterly report No. 3, September 1, November 30, 1982, 8:12050 (R:US)
Transients
Electrical overstress failure in silicon solar cells, 8:12086 (R:US)

SILICONES
Mechanical Properties
Evaluation of the use of HiSil 233 in silicone elastomers and cellular silicones, 8:12727 (R:US)
Tensile Properties
Evaluation of the use of HiSil 233 in silicone elastomers and cellular silicones, 8:12727 (R:US)

SILVER
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)

SIMS
See ION MICROPROBE ANALYSIS

SIMULATORS
Fabrication
Fabrication, interfacing, and testing of a special-purpose power-system simulator. Topical report, October 3-December 31, 1982, 8:12285 (R:US)
Performance Testing
Fabrication, interfacing, and testing of a special-purpose power-system simulator. Topical report, October 3-December 31, 1982, 8:12285 (R:US)

SINGLE CRYSTALS
See MONOCRYSTALS

SISTER CHROMATID EXCHANGES
Cytology
Measurement of sister chromatid exchange in mammalian cells, 8:13192 (BA:US)

SITES (REACTOR)
See REACTOR SITES

SKELETON
Radionuclide Kinetics
1976 Hanford americium exposure incident: in vivo measurements, 8:13147 (R:US)

SKIN
Biological Radiation Effects
1976 Hanford americium-exposure incident: histologic and autoradiographic observations on skin, 8:13150 (R:US)
Oncogenic action of ionizing radiation on rat skin. Comprehensive progress report, February 1, 1980-January 31, 1983, 8:13141 (R:US)
Genetic Radiation Effects
DNA repair, aging, and cancer, 8:13174 (J:US)

SKY
Cloud Cover
Global and diffuse solar radiation dependent on cloud amount and turbidity, 8:12005 (RA:CH)
Turbidity
Global and diffuse solar radiation dependent on cloud amount and turbidity, 8:12005 (RA:CH)

SLAGS
Chemical Composition
Shell coal gasification process, 8:11585 (RA:US)
Corrosive Effects
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)
Leaching
Shell coal gasification process, 8:11585 (RA:US)
Viscosity
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1982, 8:11653 (R:US)

SLATIS-SIEGBAHN SPECTROMETERS
See MAGNETIC LENS SPECTROMETERS

SLUDGES
See also SEWAGE SLUDGE
Chemical Composition
Chemical and physical characterization of western low-rank-coal waste materials. Part 3. Sludges from wet scrubbers using fly ash as a scrubbing reagent. Final report, 8:11683 (R:US)
Physical Properties
Chemical and physical characterization of western low-rank-coal waste materials. Part 3. Sludges from wet scrubbers using fly ash as a scrubbing reagent. Final report, 8:11683 (R:US)
Waste Disposal
Chemical and physical characterization of western low-rank-coal waste materials. Part 3. Sludges from wet scrubbers using fly ash as a scrubbing reagent. Final report, 8:11683 (R:US)

Waste Management
Impact of RCRA (PL 94-580) on the use or disposal of solid wastes from Texas lignite-fired utility boilers: a literature survey. Final report (Flue gas desulfurization sludges), 8:11687 (R:US)
SLUGS (FUEL)
See FUEL RODS
SLURRIES
See also FUEL SLURRIES
Density
Coal slurry mixing: residence time and temperature effects on SRC feed slurries, 8:11655 (R:US)
Viscosity
Coal slurry mixing: residence time and temperature effects on SRC feed slurries, 8:11655 (R:US)
SLURRIES (FUEL)
See FUEL SLURRIES
SLURRY PIPELINES
Eminent Domain
Transportation of coal by slurry pipelines (Contains description of 8 proposed slurry pipelines), 8:11745 (RA:US)
Energy Consumption
Prospects for energy conservation in the pipeline industry, 8:12589 (RA:US)
Planning
Transportation of coal by slurry pipelines (Contains description of 8 proposed slurry pipelines), 8:11745 (RA:US)
SMALL-SCALE HYDROELECTRIC POWER PLANTS
Economic Analysis
Small scale hydropower development in Illinois: an implementation manual. Final report, 8:11993 (R:US)
Feasibility Studies
Small scale hydropower development in Illinois: an implementation manual. Final report, 8:11993 (R:US)
Financing
Hydroelectric power: renewed emphasis and expanded opportunities, 8:11995 (R:US)
Legal Aspects
Hydroelectric power: renewed emphasis and expanded opportunities, 8:11995 (R:US)
Licensing
Hydroelectric power: renewed emphasis and expanded opportunities, 8:11995 (R:US)
Power Potential
Phase I report: inventory of potential small-scale hydropower sites in Illinois and selection of projects exhibiting potential for development. Final report, 8:11994 (R:US)
Site Surveys
Phase I report: inventory of potential small-scale hydropower sites in Illinois and selection of projects exhibiting potential for development. Final report, 8:11994 (R:US)
SMOKATRON
See ELECTRON-RING ACCELERATORS
SNG
See HIGH BTU GAS
SNR REACTOR
See SNR-1 REACTOR
SNR-1 REACTOR
Prior to 1977, SNR REACTOR was used.
RHR Systems
Analysis of hypothetical accidents in fast breeder reactors. Part III. Supplementary analysis of coolant disruption for Mark 1A burned-up core of the SNR-300 with the SAS 3D computer program, 8:12395 (R:DE:GE)
SNR-300 REACTOR
See SNR-1 REACTOR
SOCIO-ECONOMIC FACTORS
Evaluation
Plant construction and community stress, 8:12509 (J:US)
SOCIOLOGY
Leadership opportunities in the new age, 8:13099 (R:US)
SODIUM
Activation Analysis
Calculations on neutron dosimetry at the Chalk River Nuclear Laboratory, 8:13397 (RA:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Impurities
Determination of carbon in sodium by the distillation-combustion method, 8:12319 (R:IN)
Laser Spectroscopy
Laser-excited atomic-fluorescence spectrometery as a tool for chemical analysis, 8:12756 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Solvent Extraction
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
SODIUM 23 TARGET
Neutron Reactions
Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R:NL)
SODIUM 24
Multipole Transitions
Investigation of thermal-neutron capture in ^{23}Na, ^{138}Ba, ^{140}Ce, and ^{142}Ce, 8:13323 (R:NL)
SODIUM CHLORIDES
Phase Studies
Ultra-low IFT, phase behavior and microstructure in oil/brine/surfactant/alcohol systems, 8:11802 (J:US)
SODIUM CITRATES
See SODIUM COMPOUNDS
SODIUM COMPLEXES
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
SODIUM COMPOUNDS
See also SODIUM CHLORIDES
SODIUM HYDROXIDES
Structural Chemical Analysis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
Synthesis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
SODIUM HYDROXIDES
Chemical Analysis
Applications of ion chromatography, 8:12747 (R:US)
SODIUM LAURYL SULFATES
See SODIUM COMPOUNDS
SODIUM MINERALS
See MINERALS
SODIUM-WATER REACTIONS
See MOLTEN METAL-WATER REACTIONS
SOILS
Acidification
Regional assessment of potential sensitivity of soils in the eastern United States to acid precipitation, 8:13062 (R:US)
Contamination
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Leaching
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
PH Value
Characterization and analysis of oil-contaminated soil samples from the Fort Lewis coal-liquefaction pilot plant. Final report, 8:11691 (R:US)
Radioactivity
Aerial radiological survey of the Argonne National Laboratory and surrounding area, Argonne, Illinois. Date of survey: May 1977, 8:13064 (R:US)

Radionuclide Migration
Multidimensional simulation of radon diffusion through earthen covers, 8:11922 (R:US)
Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R:US)
Stabilization
Consolidation theory and its applicability to the dewatering and covering of uranium-mill tailings, 8:11924 (R:US)

SOLAR AIR CONDITIONERS
See also SOLAR-ASSISTED HEAT PUMPS
Computerized Simulation
Solar-regenerated desiccant dehumidification. Final report, 8:12170 (R:US)
Desiccants
Solar-regenerated desiccant dehumidification. Final report, 8:12170 (R:US)
Performance Testing
Solar-regenerated desiccant dehumidification. Final report, 8:12170 (R:US)

SOLAR AIR CONDITIONING
Constraints
Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R:US)
Economic Analysis
Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R:US)
Institutional Factors
Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R:US)

SOLAR BATTERIES
See SOLAR CELL ARRAYS

SOLAR CELL ARRAYS
See also SOLAR TRACKING SYSTEMS
Computerized Simulation
Photovoltaic-array/power-conditioner interface, 8:12109 (R:US)
Design
Development and installation of a 2-kW photovoltaic array at Poynton, nr Manchester. Final report, 8:12059 (R:XE)
Equipment Interfaces
Photovoltaic-array/power-conditioner interface, 8:12109 (R:US)
Failures
Development and installation of a 2-kW photovoltaic array at Poynton, nr Manchester. Final report, 8:12059 (R:XE)

SOLAR CELL RECEIVERS
See SOLAR RECEIVERS

SOLAR CELLS
See also CONCENTRATOR SOLAR CELLS
MIS SOLAR CELLS
SILICON SOLAR CELLS
Seven technologies for the eighties, 8:12470 (R:US)
Computer Codes
PV-cell data-reduction computer program (draft) (PV-TAP, PVDR), 8:12087 (R:US)
Data Analysis
PV-cell data-reduction computer program (draft) (PV-TAP, PVDR), 8:12087 (R:US)
Electrodes
Optimization of transparent electrode for solar cell. Technical report, 15 September 1981-14 September 1982, 8:12094 (R:US)
Environmental Impacts
Photovoltaics: state-of-knowledge survey of environmental, health and safety aspects, 8:12046 (R:US)
Health Hazards
Photovoltaics: state-of-knowledge survey of environmental, health and safety aspects, 8:12046 (R:US)
Safety
Photovoltaics: state-of-knowledge survey of environmental, health and safety aspects, 8:12046 (R:US)

SOLAR COOLING SYSTEMS
See also PASSIVE SOLAR COOLING SYSTEMS
SOLAR AIR CONDITIONERS
Performance
Thermal performance case studies for residential solar heating and cooling systems. Final report, 8:12165 (R:US)

SOLAR DOMESTIC WATER HEATING
See SOLAR WATER HEATING

SOLAR ENERGY
Energy Models
Technology assessment of solar energy systems. Scenario development and methodology. Volume II, 8:12019 (R:US)
Marketing Research
Homeowners survey: gas utilities and the residential solar market, 8:12640 (R:US)
Public Opinion
Homeowners survey: gas utilities and the residential solar market, 8:12640 (R:US)
Research Programs
Texas Energy Development Fund. Project status reports, 8:11998 (R:US)
Socio-Economic Factors
Technology assessment of solar energy systems. Socioeconomic impacts of solar deployment and conventional energy use. Volume III, 8:12020 (R:US)
Technology Assessment
Technology assessment of solar energy systems. Scenario development and methodology. Volume II, 8:12019 (R:US)
Technology assessment of solar energy systems. Socioeconomic impacts of solar deployment and conventional energy use. Volume III, 8:12020 (R:US)

SOLAR FLUX
Mathematical Models
Measurement and modelling of solar radiance, 8:12003 (RA:CH)

SOLAR HEATING SYSTEMS
See also PASSIVE SOLAR HEATING SYSTEMS
SOLAR-ASSISTED HEAT PUMPS
Computer Codes
Final progress report for European Modelling Group, 8:12159 (R:XE)
Computerized Simulation
Final progress report for European Modelling Group, 8:12159 (R:XE)
Design
Corona del Sol High School solar system, Tempe Union High School District No. 213. Final technical report (Engineering Materials), 8:12174 (E:US)
Design procedure for solar industrial-process-heat systems in Texas. Final report, 8:12169 (R:US)
Solar-augmented applications in industry. Phase II: conceptual designs, volume 1. Final report Jun 80-Dec 81, 8:12166 (R:US)
Solar-heated greenhouse utilizing water reservoir. Final technical progress report. Appropriate-Technology Small-Grants Program, 8:12157 (R:US)
Economic Analysis
Design procedure for solar industrial-process-heat systems in Texas. Final report, 8:12169 (R:US)
Economic Impact
Technology assessment of solar energy systems. Socioeconomic impacts of solar deployment and conventional energy use. Volume III, 8:12020 (R:US)
Engineering Drawings
Corona del Sol High School solar system, Tempe Union High School District No. 213. Final technical report (Engineering Materials), 8:12174 (E:US)
Hybrid Systems
Solar-augmented applications in industry. Phase II: conceptual designs, volume 1. Final report Jun 80-Dec 81, 8:12166 (R:US)
Technological aspects of the mixed use of solar and wind energy, 8:12108 (RA:CH)
Installation
Revised draft installation standards for solar-energy systems, 8:12022 (R:US)
Performance
Solar-heated greenhouse utilizing water reservoir. Final technical progress report. Appropriate-Technology Small-Grants Program, 8:12157 (R:US)
Thermal performance case studies for residential solar heating and cooling systems. Final report, 8:12165 (R:US)

Performance Testing
Corona del Sol High School solar system, Tempe Union High School District No. 213. Final technical report (Engineering Materials), 8:12174 (E:US)
Solar monitoring by Pacific Gas and Electric Company, 8:12149 (RA:US)
Standards
Revised draft installation standards for solar-energy systems, 8:12022 (R:US)
Technology Assessment
Technological aspects of solar energy utilization, 8:12107 (RA:CH)
Uses
Technological aspects of solar energy utilization, 8:12107 (RA:CH)

SOLAR INDUSTRY
Financial Assistance
Survey of manufacturers of solar-thermal-energy systems, 8:12179 (R:US)
Materials
Technology assessment of solar-energy systems. Materials resource and hazardous materials impacts of solar deployment, 8:12021 (R:US)
Surveys
Survey of manufacturers of solar-thermal-energy systems, 8:12179 (R:US)

SOLAR NEUTRINOS
Prior to July, 1975 information was indexed to NEUTRINOS.
Neutrino Detection
^{7}Be decay scheme and the solar-neutrino problem, 8:13227 (R:US)
Particle Production
Solar neutrino production of technetium-97 and technetium-98, 8:13233 (J:US)

SOLAR POWER PLANTS
See also OCEAN THERMAL POWER PLANTS
PHOTOVOLTAIC POWER PLANTS
SOLAR THERMAL POWER PLANTS
Hybrid Systems
Technological aspects of the mixed use of solar and wind energy, 8:12108 (RA:CH)

SOLAR PROCESS HEAT
Design procedure for solar industrial-process-heat systems in Texas. Final report, 8:12169 (R:US)

SOLAR RADIATION
Spectra
Spectral measurements of solar radiation at the Royal Meteorological Institute of Belgium, 8:12004 (RA:CH)

SOLAR RECEIVERS
See also CENTRAL RECEIVERS
Chemical Reactors
High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982, 8:12057 (R:US)
Design
High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982, 8:12057 (R:US)

SOLAR SEA POWER PLANTS
See OCEAN THERMAL POWER PLANTS

SOLAR SPACE HEATING
Constraints
Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R:US)
Economic Analysis
Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R:US)
Institutional Factors
Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R:US)

SOLAR SYSTEM
Age Estimation
Cosmic clocks, 8:13228 (R:US)

SOLAR THERMAL POWER PLANTS
See also DISTRIBUTED COLLECTOR POWER PLANTS
TOWER FOCUS POWER PLANTS
Environmental Impacts
Possible effects of solar energy conversion on meteorological conditions, 8:12018 (RA:CH)

SOLAR THERMAL RECEIVERS
See SOLAR RECEIVERS

SOLAR TRACKING SYSTEMS
Performance Testing
Development of a solar-flux tracker for parabolic-trough collectors, 8:12180 (R:US)

SOLAR WATER HEATERS
Comparative Evaluations
SDG and E solar heating system data reduction and analysis techniques, 8:12136 (RA:US)
Data Analysis
Measurement and data reduction techniques: solar water preheat systems, Illinois Power Company, 8:12139 (RA:US)
SDG and E solar heating system data reduction and analysis techniques, 8:12136 (RA:US)
Economic Analysis
Solar domestic hot water project, 8:12137 (RA:US)
F-Chart
Uses and abuses of f-chart, 8:12146 (RA:US)
Field Tests
Bonneville Power Administration's solar domestic hot water monitoring program - program administration and technical issues, 8:12142 (RA:US)
Comparison of the results from six regional solar water heater field test programs, 8:12145 (RA:US)
Evaluating water heating alternatives, 8:12140 (RA:US)
Proceedings of the solar-hot-water field-test technical review meeting, 8:12135 (R:US)
Inspection
Solar domestic hot water monitoring - what we have learned, 8:12148 (RA:US)
Installation
Revised draft installation standards for solar-energy systems, 8:12022 (R:US)
Maintenance
Early-life maintenance requirements of 124 HUD-approved SDHW systems installed between 1978 and 1980, 8:12151 (RA:US)
Meetings
Proceedings of the solar-hot-water field-test technical review meeting, 8:12135 (R:US)
Performance
Measurement and data reduction techniques: solar water preheat systems, Illinois Power Company, 8:12139 (RA:US)
Performance and reliability of residential solar water heaters, 8:12138 (RA:US)
Solar domestic hot water project, 8:12137 (RA:US)
Performance Testing
Monitoring and performance of solar domestic hot water systems in Oregon, 8:12143 (RA:US)
Monitoring solar water heater performance by alternating between resistance and solar systems, 8:12144 (RA:US)
Results of TVA monitoring of residential solar water heaters, 8:12147 (RA:US)
Solar assist water heating, 8:12141 (RA:US)
Solar domestic hot water monitoring - what we have learned, 8:12148 (RA:US)
Solar monitoring by Pacific Gas and Electric Company, 8:12149 (RA:US)
Reliability
Operational status of 134 solar water heaters in the southeastern United States, 8:12150 (RA:US)
Performance and reliability of residential solar water heaters, 8:12138 (RA:US)
Standards
Revised draft installation standards for solar-energy systems, 8:12022 (R:US)

SOLAR WATER HEATING
Use for solar domestic water heating; not for process hot water.
Constraints
Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R:US)
Economic Analysis
Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R:US)

Institutional Factors
Solar energy: an economic analysis. Part I and II. Final report, 8:12017 (R:US)

SOLAR-ASSISTED HEAT PUMPS
Design
Solar-assisted heat pumps and alternative-energy-awareness demonstration. Final report, 8:12172 (R:US)
Feasibility Studies
Solar/gas Rankine/Rankine-cycle heat pump assessment. Final report Mar 81-Jul 82, 8:12164 (R:US)
Solar/gas Brayton/Rankine cycle heat pump assessment. Final report Apr 81-May 82, 8:12167 (R:US)
Performance
Solar-assisted heat pumps and alternative-energy-awareness demonstration. Final report, 8:12172 (R:US)
Waste Heat Utilization
Solar/gas Brayton/Rankine cycle heat pump assessment. Final report Apr 81-May 82, 8:12167 (R:US)

SOLID WASTES
See also MINERAL WASTES
TAILINGS
WOOD WASTES
Chemical Composition
Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs, 8:11681 (R:US)
Particle Size Classifiers
Fundamental aspects of air classifier operation and design, 8:12631 (R:US)
Regulations
Pending changes in the regulation of solid waste disposal and underground injection: impact of state programs in lieu of federal programs, 8:12221 (RA:US)
Waste Disposal
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Pending changes in the regulation of solid waste disposal and underground injection: impact of state programs in lieu of federal programs, 8:12221 (RA:US)
Solid wastes from coal gasification and liquefaction in the Fort Union region: background, properties, environmental effects, research needs, 8:11681 (R:US)

SOLIDS
Aerodynamic Heating
LOVEL: a low-velocity aerodynamic heating code for flat-plates, wedges, and cones, 8:12872 (R:US)
Fluid Flow
Research and development leading to the preparation of a gravity flow of solids media engineering databook for coal conversion and utilization processes. Phase I. Final technical report, 8:11752 (R:US)

SOLUTES
Environmental Transport
Contaminant migration in saturated unconsolidated geologic deposits, 8:13200 (J:US)

SOLVENT-REFINED COAL PROCESS
See SRC PROCESS

SOLVENT-REFINING COAL PLANTS
See COAL PREPARATION PLANTS
SRC PROCESS

SOOT
Chemical Reaction Yield
Agglomeration of polyacetylenic particulates and its relation to soot formation, 8:12821 (RA:US)
Soot formation in synthetic-fuel droplets. Eighth quarterly technical progress report, July 1-September 30, 1982, 8:11961 (R:US)

SORBITOL
Synthesis
Design, evaluation, and application of continuous-flow cells for organic electrochemical synthesis. Final report, 8:12814 (R:US)

SORGHUM
Energy Source Development
Forage crops can be a source of ethanol, 8:12106 (J:US)

SOUTH CAROLINA
Geological Surveys
State resource estimation: South Carolina, 8:11698 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Peat resource estimation in South Carolina, 8:11714 (RA:US)
State resource estimation: South Carolina, 8:11698 (RA:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)

SOUTH DAKOTA
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)

SOUTH KOREA
See REPUBLIC OF KOREA

SOVIET UNION
See USSR

SOYBEANS
Fermentation
Preliminary studies on utilization of soybean milling residue for the production of alcohol, 8:12029 (RA:BR)

SP GROUPS
Matrix Elements
Generating invariants of Sp(6, R) model, 8:13362 (RA:SU:In Russian)

SPACE HEATING
See also SOLAR SPACE HEATING
Energy Conservation
Options for electricity use and management during a petrolcum shortage, 8:12508 (R:US)
Power Demand
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)

SPACE HVAC SYSTEMS
Heating, ventilation, and air conditioning systems.
Energy Demand
Effects of atmospheric variability on energy utilization and conservation, 8:12555 (RA:CH)

SPACE LATTICES
See CRYSTAL LATTICES

SPACE POWER REACTORS
See also SPACE PROPULSION REACTORS
Radiators
Conceptual designs for 100-MW space radiators, 8:12322 (R:US)

SPACE PROPULSION REACTORS
Research Programs
Research needs: prime-power for high energy space systems. Final report 26 Oct 81-31 Jul 82, 8:12381 (R:US)

SPACE VEHICLES
Thrusters
Research needs: prime-power for high energy space systems. Final report 26 Oct 81-31 Jul 82, 8:12381 (R:US)

SPACECRAFT POWER SUPPLIES
Thermoelectric Generators
Quality assurance program for isotopic power systems, 8:12518 (R:US)

SPARK IGNITION ENGINES
Exhaust Gases
Plasma-jet ignition in a lean-burn CFR engine, 8:12645 (R:US)
Fuel Consumption
Engine study of efficiency and fuel consumption with ethanol fuel, 8:12653 (RA:BR)
Fuel Substitution
Alternative engine fuels: educational demonstration project. Final report, 8:12655 (R:US)
Engine study of efficiency and fuel consumption with ethanol fuel, 8:12653 (RA:BR)
Ignition Systems
Plasma-jet ignition in a lean-burn CFR engine, 8:12645 (R:US)

SPECTRALLY SELECTIVE SURFACES
Optical Properties
Optimization of solar-selective paint coatings. Final report, September 15, 1980-June 15, 1982, 8:12176 (R:US)

Optimization
Optimization of solar-selective paint coatings. Final report, September 15, 1980-June 15, 1982, 8:12176 (R:US)
Stability
Evaluation of solar selective coating stability. Final report, September 1, 1978-May 31, 1980, 8:12178 (R:US)

SPECTROMETERS
See also GAMMA SPECTROMETERS
MAGNETIC SPECTROMETERS
X-RAY SPECTROMETERS
Statistics
Basic statistics for nuclear electronics, 8:12949 (R:XE:In Italian)

SPENT FUEL CASKS
Accidents
Subjecting spent-fuel shipments to extreme environments, 8:11862 (J:US)
Design
Breeder reactor program T-3 cask, 8:12445 (J:US)
Scoping design analyses for optimized shipping casks containing 1-, 2-, 3-, 5-, 7-, or 10-year-old PWR spent fuel, 8:12855 (R:US)
Optimization
Scoping design analyses for optimized shipping casks containing 1-, 2-, 3-, 5-, 7-, or 10-year-old PWR spent fuel, 8:12855 (R:US)
Remote Handling
T-3 cask handling systems at HFEF, 8:12446 (J:US)
Risk Assessment
Subjecting spent-fuel shipments to extreme environments, 8:11862 (J:US)

SPENT FUEL ELEMENTS
Chemical Composition
TRIFOB code for calculating the isotope composition change in a cylindrical reactor cell with detailed accounting for neutron spatial and energy distribution, 8:12341 (R:SU:In Russian)
Isotope Ratio
TRIFOB code for calculating the isotope composition change in a cylindrical reactor cell with detailed accounting for neutron spatial and energy distribution, 8:12341 (R:SU:In Russian)

SPENT FUEL STORAGE
See also DRY STORAGE
ONWI library reports list, 8:11892 (R:US)
Cost
Evaluations of alternatives for on-site spent fuel storage, 8:11855 (J:US)
Economic Analysis
Economics of monitored retrievable storage of nuclear wastes, 8:11858 (J:US)
Planning
Overview of the Monitored Retrievable Storage (MRS) program, 8:11904 (R:US)
Research Programs
Commercial nuclear-waste research and development program. Quarterly report, July-September 1982, 8:11874 (R:US)
Commercial nuclear waste research and development program. Annual report, fiscal year 1982, 8:11875 (R:US)
Retrieval Systems
Background and historical perspectives for monitored retrievable storage, 8:11856 (J:US)
Site Selection
Screening for monitored retrievable storage facility locations, 8:11857 (J:US)
Temperature Distribution
Effects of boundary conditions on thermomechanical calculations: Spent fuel test - climax, 8:11913 (R:US)

SPENT FUELS
Remote Handling
Industry-standard manipulator integrated maintenance system. Consolidated Fuel-Reprocessing Program, 8:12842 (R:US)
Reprocessing
APEX nuclear fuel cycle for production of LWR fuel and elimination of radioactive waste, 8:11849 (J:US)

SPHEROMAK DEVICES
ICR Heating
Spheromak ICRF heating studies at low power, 8:13439 (R:US)
Impurities
Spectroscopic studies of impurity control in coaxial sources for spheromaks at Los Alamos, 8:13437 (R:US)
Operation
Current results from the Los Alamos CTX spheromak, 8:13438 (R:US)
Plasma Heating
Computational simulation of spheromak plasma heating, 8:13420 (R:US)

SPRAY PONDS
See SPRAYS

SPRAYS
Combustion
Percolation in combusting sprays I: transition from cluster combustion to percolate combustion in non-premixed sprays, 8:12834 (RA:US)

SRC PROCESS
Engineering
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)

SRC-II PROCESS
Development of new catalysts for coal liquids refining. Final report, January 1979-April 1981, 8:11615 (R:US)
Engineering
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Marketing Research
SRC-II product applications - recent developments, 8:11595 (RA:US)
Pilot Plants
Wilsonville Advanced Coal-Liquefaction Research and Development Facility, Wilsonville, Alabama: Run 240 with Illinois 6 coal. Technical progress report (Run 240; non-integrated two stage), 8:11641 (R:US)

STABILITY (REACTOR)
See REACTOR STABILITY

STADE REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)

STAINLESS STEEL-21-6-9
Acoustic Testing
Acoustic emission under biaxial stresses in unflawed 21-6-9 and 304 stainless steel, 8:12701 (J:GB)

STAINLESS STEEL-304
Acoustic Testing
Acoustic emission under biaxial stresses in unflawed 21-6-9 and 304 stainless steel, 8:12701 (J:GB)
Corrosion
Corrosion rates and evaluations of structural materials on the North Atlantic Continental Rise, 8:12683 (R:US)
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)

STAINLESS STEEL-310
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)

STAINLESS STEEL-316
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
Fabrication
Improved specifications for fast reactor fuel, 8:12370 (R:US)
Permeability
Tritium permeation scoping test, 8:13486 (R:US)

STAINLESS STEEL-410
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)

STAINLESS STEELS
See also STAINLESS STEEL-21-6-9
STAINLESS STEEL-304
STAINLESS STEEL-310

STAINLESS STEEL-316
STAINLESS STEEL-410
Corrosion
Corrosion rates and evaluations of structural materials on the North Atlantic Continental Rise, 8:12683 (R:US)
Microstructure
Use of analytical electron microscopy and auger electron spectroscopy for evaluating materials, 8:12760 (R:US)
Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)

STANDARDS
See also CALIBRATION STANDARDS
ENERGY EFFICIENCY STANDARDS
SAFETY STANDARDS
Fuel Economy
Automotive fuel economy - improvement potentials and strategies: manufacturer's viewpoint, 8:12593 (RA:US)

STANDING CROP
See BIOMASS

STANFORD 20-GEV LINAC
Beam Monitors
Beam Intensity Monitor (accelerator drift section) (Engineering Materials), 8:12935 (E:US)

STANFORD LINEAR ACCELERATOR CENTER
Computerized Control Systems
SLAC Touch Panel Model 4 (Engineering Materials), 8:12936 (E:US)

STARCH
Biosynthesis
Detection of changes in maize DNA at the shrunken locus due to the intervention of Ds elements, 8:13125 (J:US)

STARFIRE TOKAMAK
Breeding Blankets
Thermal-hydraulics design considerations for the STARFIRE-DEMO breeding blanket, 8:13516 (J:US)

START-UP (REACTOR)
See REACTOR START-UP

STATE BUILDINGS
See PUBLIC BUILDINGS

STATISTICS
Limited to the indexing of information on the mathematical discipline of statistics or its application in other scientific disciplines; for indexing numerical values of a statistical nature use STATISTICAL DATA.
See also REGRESSION ANALYSIS
Parametric statistical methods and sample-size considerations for dominant lethal experiments: the use of clustering to achieve approximate normality, 8:13179 (R:US)
Parametric Analysis
Estimating tail probabilities, 8:13408 (R:US)

STEAM GENERATORS
Acoustic Measurements
Measurement of acoustic background noise on the EBR-II steam generators, 8:12378 (J:US)
Boiling
Boiling in narrow crevices in steam generators. Final report, 8:12305 (R:US)
Feedwater
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
Fuel Substitution
Feasibility study for alternative-fuels production: fluidized-bed gasification of wood waste. Biomass Alternative-Fuels Program: final report, 8:12051 (R:US)
Fluidized-bed retofit study of C-E VUX-type boiler at the Jamestown Board of Public Utilities Carlson Station, Jamestown, New York, 8:12623 (R:US)
Materials
Experiences and data of a German 7-million lbs/hour 500 MW co-generation system, 8:12615 (RA:US)
Performance
Effect of tube plugging in the thermalhydraulic performance of 'U' tube steam generators, 8:12309 (R:BR:In Portuguese)
Surface Cleaning
Electrochemical behavior of ferrous and ferric ions in EDTA/N_2H_4 solutions (PWR), 8:12306 (R:US)
Investigation of on-line chelant addition to PWR steam generators. Annual report, 1981, 8:12302 (R:US)
Two-Phase Flow
Boiling in narrow crevices in steam generators. Final report, 8:12305 (R:US)
Water Chemistry
Investigation of on-line chelant addition to PWR steam generators. Annual report, 1981, 8:12302 (R:US)
Water Treatment
Operating experience in burning lignite at Coal Creek Station, 8:11756 (RA:US)

STEAM INJECTION
Technology Assessment
Light oil steamflooding: an emerging technology, 8:11793 (RA:US)

STEAM REFORMER PROCESSES
Bench-Scale Experiments
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)
Catalysts
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)
State of the art: steam hydrocarbon reforming, 8:11955 (RA:US)
Chemical Feedstocks
State of the art: steam hydrocarbon reforming, 8:11955 (RA:US)
Chemical Reaction Kinetics
Gasification of fuels in molten sodium phosphate. Final report, 8:11614 (R:US)
Chemical Reactors
State of the art: steam hydrocarbon reforming, 8:11955 (RA:US)
Technology Assessment
State of the art: steam hydrocarbon reforming, 8:11955 (RA:US)

STEEL INDUSTRY
See METAL INDUSTRY

STEEL-40KH
Surface Properties
Studying the phase composition of surface zones in white layers obtained during steel frictional-strengthening treatment, 8:12672 (RA:SU:In Russian)

STEEL-ASTM-A516
Corrosion
Corrosion rates and evaluations of structural materials on the North Atlantic Continental Rise, 8:12683 (R:US)

STEELS
See also CARBON STEELS
STAINLESS STEELS
STEEL-ASTM-A516
Corrosion
Corrosion rates and evaluations of structural materials on the North Atlantic Continental Rise (HY 80), 8:12683 (R:US)
Fracture Properties
Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982, 8:12294 (R:US)
Physical Radiation Effects
Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982, 8:12294 (R:US)
Thermal Stresses
Heavy-Section Steel Technology Program. Quarterly progress report, April-June 1982, 8:12294 (R:US)

STILLAGE
Marketing Research
Feasibility study for a 40-MGY/80-MGY fuel alcohol production plant. Volume 3. Market survey and economic analysis, 8:11978 (R:US)

STIMULATED EMISSION DEVICES
See LASERS

STIRLING ENGINES
Testing
600-watt free-piston Stirling engine generator. Final report, 8:12622 (R:US)
Thermal Efficiency
Two-phase, two-component Stirling engine with controlled evaporation, 8:12648 (R:US)

Wood Fuels
Biomass fueled Stirling engine system research and development, 8:12081 (RA:US)
Working Fluids
Two-phase, two-component Stirling engine with controlled evaporation, 8:12648 (R:US)
STOCHASTIC PROCESSES
Computer Calculations
Calculations related to quantum stochasticity, an example of overlapping avoided crossings, 8:13412 (J:NL)
STORAGE BATTERIES
See ELECTRIC BATTERIES
STORAGE BATTERIES (LEAD-ACID)
See LEAD-ACID BATTERIES
STORAGE FACILITIES
Cost
Report on the engineering and economics of an ethanol/gasohol joint-venture project with Caldwell Sugars Co-op, Inc. at Thibodaux, Louisiana. Attachment B, Volume III. Definitive estimate. Section 1: terminal, 8:12016 (R:US)
STORAGE (SPENT FUEL)
See SPENT FUEL STORAGE
STORES
See COMMERCIAL BUILDINGS
STOVER
See AGRICULTURAL WASTES
STRAND BREAKS
Radioinduction
Single-strand breaks induced in Bacillus subtilis DNA by ultraviolet light: action spectrum and properties, 8:13163 (J:GB)
STRATEGIC PETROLEUM RESERVE
Evaluation of policy options for increasing domestic oil inventories. Final report, 8:11789 (R:US)
STRATOSPHERE
Remote Sensing
Planning of a C-band-pulse-Doppler-radar with polarization diversity for atmospheric research in the meso-scale range, 8:13021 (R:DE:In German)
STRAW
Combustion
Evaluation of a system utilizing biomass (straw) as fuel for crop drying and heating on the farm, 8:12064 (R:CA)
STREAMING (RADIATION)
See RADIATION STREAMING
STREAMS
Energy Budgets
Organic energy budget of Rattlesnake Springs, Washington, 8:13075 (J:US)
Geochemical Surveys
Evaluation of uranium geochemical anomalies in the Charlotte 1° x 2° NTMS quadrangle, 8:11829 (R:US)
STRESS ANALYSIS
Finite Element Method
Effect of geometric shape on two-dimensional finite elements, 8:12699 (J:NL)
STRIPPING
For nuclear reactions only; for electron stripping use ELECTRON LOSS.
Coupled Channel Theory
Non-Born methods in the direct nuclear reaction theory, 8:13371 (RA:SU:In Russian)
STRONG INTERACTIONS
Coupling Constants
Analysis of the energy weighted angular correlations in hadronic e^+e^- annihilations at 22 and 34 GeV, 8:13255 (R:DE)
STRONTIUM
Adsorption
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Leaching
Strontium leachability of hydrofracture grouts for sludge-slurries, 8:11866 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Precipitation
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Solubility
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Solvent Extraction
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)
STRONTIUM 82
Beta-Plus Decay
Calculations of the interference of annihilation radiations with positron spectra in a Ge detector, 8:13000 (J:NL)
STRONTIUM 90
Diffusion
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Inventories
Strontium-90 and promethium-147 recovery, 8:11951 (R:US)
Production
Additional Pu-238 production, 8:11952 (R:US)
Radioisotopes for heat-source applications, 8:11953 (R:US)
Radioecological Concentration
Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R:US)
Sediment and radionuclide transport in rivers: radionuclide transport modeling for Cattaraugus and Buttermilk Creeks, New York, 8:13090 (R:US)
Radioisotope Heat Sources
Additional Pu-238 production, 8:11952 (R:US)
Radioisotopes for heat-source applications, 8:11953 (R:US)
Strontium-90 and promethium-147 recovery, 8:11951 (R:US)
STRONTIUM HYDRIDES
Phase Studies
Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen, and vanadium alloys, 8:12712 (R:US)
STRUCTURES (BUILDINGS)
See BUILDINGS
SUBSIDENCE (GROUND)
See GROUND SUBSIDENCE
SUBSONIC FLOW
Boundary Layers
LOVEL: a low-velocity aerodynamic heating code for flat-plates, wedges, and cones, 8:12872 (R:US)
SUBURBS
See URBAN AREAS
SUGAR CANE
Processing
Analysis of possible yield improvement in the industrial processing of sugarcane to alcohol, 8:12038 (RA:BR)
SULFATES
See also CALCIUM SULFATES
COPPER SULFATES
IRON SULFATES
ZINC SULFATES
Monitoring
Effect of using time-averaged precipitation for wet removal in a Lagrangian assessment model, 8:13030 (R:US)
Phase Studies
Liquid crystals and microemulsions in oil recovery, 8:11801 (J:US)
SULFIDES
See also CADMIUM SULFIDES
CARBON SULFIDES
MOLYBDENUM SULFIDES
NICKEL SULFIDES
TUNGSTEN SULFIDES
Polarography
Instrumental methods of analysis of sulfur compounds in synfuel process streams. Quarterly technical progress report,

July-September 1982 (Thermometric titration of polysulfides with p-hydroxymercuribenzoate), 8:11670 (R:US)
Synthesis
Studies of molybdenum-molybdenum bonded species. 1. Synthesis and characterization of a reduction product of $Cs_3Mo_2Cl_8H$. 2. Mixed sulfur/chlorine-substituted hexanuclear molybdenum clusters, 8:12785 (R:US)
Titration
Instrumental methods of analysis of sulfur compounds in synfuel process streams. Quarterly technical progress report, July-September 1982 (Thermometric titration of polysulfides with p-hydroxymercuribenzoate), 8:11670 (R:US)

SULFONATES
For salts of sulfonic acids; for esters see SULFONIC ACID ESTERS.
See also PETROLEUM SULFONATES
Chemical Reactions
Sulfonate precipitation-redissolution-reprecipitation in inorganic electrolytes, 8:12801 (J:US)
Phase Studies
Liquid crystals and microemulsions in oil recovery, 8:11801 (J:US)

SULFONIC ACIDS
Synthesis
Metal-ion complexation by ionic-crown ethers. Progress report, 8:12803 (R:US)

SULFUR
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Retention
Analysis of sulfur retention in fluidized-bed combustion, 8:11770 (RA:US)
Fluidized-bed combustion studies of Texas lignite, 8:11769 (RA:US)

SULFUR 35
Biological Effects
Inducible cadmium binding complexes of cabbage and tobacco, 8:13111 (J:US)

SULFUR CARBIDES
See CARBON SULFIDES

SULFUR COMPOUNDS
See also CARBON OXYSULFIDE
SULFATES
SULFIDES
Chemical Analysis
Instrumental methods of analysis of sulfur compounds in synfuel process streams. Quarterly technical progress report, July-September 1982, 8:11670 (R:US)

SULFUR DIOXIDE
Atmospheric Chemistry
Acid deposition in Texas: technical summary and perspective. Final report, 8:13033 (R:US)
Plan to evaluate acid-deposition issues in the state of Texas. Final report, 8:13032 (R:US)
Monitoring
Effect of using time-averaged precipitation for wet removal in a Lagrangian assessment model, 8:13030 (R:US)
Resumption of exploratory drilling operations by Texaco, Inc.: state oil and gas leases - PRC 2725.1 (Jade Prospect), PRC 2206.1 (Anita Prospect), PRC 2955.1 (Refugio Prospect), Santa Barbara County. Final environmental impact report, 8:13101 (R:US)

SULFUR SULFIDES
See SULFUR

SULFURIC ACID
Chemical Reaction Kinetics
Partial-equilibrium model based on the kinetics of dissolution and equilibrium in solution of the UO_3-FeS_2-$Fe_2(SO_4)_3$-H_2SO_4 system, 8:12823 (R:US)
Distillation
Pt. 3. Acid separation, 8:11886 (RA:XE:In German)
Recycling
Pt. 3. Acid separation, 8:11886 (RA:XE:In German)

SUNFLOWERS
Oils
Economic and engineering evaluation of plant oils as a diesel fuel. Final report, 8:12102 (R:US)
Yields
Economic and engineering evaluation of plant oils as a diesel fuel. Final report, 8:12102 (R:US)

SUPER HIGH FREQUENCY RADIATION
See RADIOWAVE RADIATION

SUPERCONDUCTING CAVITY RESONATORS
Control Systems
Conceptual design of the electronic controls for the RF cavity of the Milan Superconducting Cyclotron, 8:12919 (R:IT)
Phase Stability
Conceptual design of the electronic controls for the RF cavity of the Milan Superconducting Cyclotron, 8:12919 (R:IT)

SUPERCONDUCTING COMPOSITES
Stability
Stability of NbTi composite superconductors of high CU/SC-ratio, 8:12848 (R:DE:In English)

SUPERCONDUCTING MAGNETS
Design
Design concept for the FED poloidal field coils using an internally cooled cable superconductor, 8:13491 (R:US)
Design conditions for fail-safe quenching of a high-current-density superconducting solenoid with a shorted secondary circuit, 8:12852 (R:US)
Magnetic Fields
MULTIC program for computing three-dimensional magnetic fields of superconducting magnets, 8:12847 (R:SU:In Russian)
Quenching
Design conditions for fail-safe quenching of a high-current-density superconducting solenoid with a shorted secondary circuit, 8:12852 (R:US)
Refrigeration
Design concept for the FED poloidal field coils using an internally cooled cable superconductor, 8:13491 (R:US)
Research Programs
Materials and Molecular Research Division. Annual report 1981, 8:13535 (R:US)
Ultrasonic Testing
Ultrasonic examination of JBK-75 strip material, 8:13493 (R:US)

SUPERCONDUCTORS
Physical Radiation Effects
Effect of neutron irradiation on the critical temperature of Nb_3Ge, 8:12735 (RA:CS:In Czech)

SUPERCRITICAL GAS EXTRACTION
Supercritical fluids for extraction and reaction of coal and heavy oils. First quarterly progress report, September 1, 1982-December 1, 1982 (Different liquids, different density, methods of mixing, and study of model compounds as well as coal), 8:11633 (R:US)
Use of supercritical water for extraction of low rank coals, 8:11634 (RA:US)
Organic Solvents
Solvent and chemical-reaction effects in supercritical extraction of coal. Fifth quarterly technical progress report, September 1-November 30, 1982, 8:11636 (R:US)
Thermodynamics
Supercritical behavior in multicomponent system, 8:11635 (RA:US)

SUPERLATTICES
Graded Band Gaps
Ga(As,P) strained-layer superlattices: a ternary semiconductor with independently adjustable band gap and lattice constant, 8:12886 (R:US)
Lattice Parameters
Ga(As,P) strained-layer superlattices: a ternary semiconductor with independently adjustable band gap and lattice constant, 8:12886 (R:US)

SUPEROXIDE RADICALS
O_2

Research Programs
Nature of oxygen-containing radicals in radiation chemistry and photochemistry of aqueous solutions. Annual progress report, July 1981-June 1982, 8:12820 (R:US)

SUPERSONIC FLOW
Boundary Layers
LOVEL: a low-velocity aerodynamic heating code for flat-plates, wedges, and cones, 8:12872 (R:US)

SUPERSYMMETRY
Topics in phenomenology of unified gauge theories of weak, electromagnetic, and strong interactions, 8:13289 (R:US)
Symmetry Breaking
Research in theoretical physics. Annual progress report, April 1, 1982-March 31, 1983, 8:13286 (R:US)

SUPERTANKERS
See TANKER SHIPS

SUPERVOLTAGE RADIOTHERAPY
See RADIOTHERAPY

SUPPLY DISRUPTION
Emergency Plans
Report to the Congress: comprehensive energy - emergency response procedures, 8:11810 (R:US)

SURFACE BARRIER DETECTORS
Charge Collection
Charge collection in silicon strip detectors, 8:12943 (R:US)
Design
Neutron dosimetry development program at Rocky Flats, 8:12990 (RA:US)
Energy Dependence
Neutron dosimetry development program at Rocky Flats, 8:12990 (RA:US)
Spatial Resolution
Charge collection in silicon strip detectors, 8:12943 (R:US)

SURFACE CLEANING
Investigation of on-line chelant addition to PWR steam generators. Annual report, 1981, 8:12302 (R:US)

SURFACE COATING
Fabrication
Coating Processes Group progress report, September-October 1982, 8:12690 (R:US)
Research Programs
Coating Processes Group progress report, September-October 1982, 8:12690 (R:US)

SURFACE MINING
Environmental Effects
Evaluation of environmental issues on the use of peat as an energy source, 8:11690 (RA:US)
Fifth technical contractors' conference on peat, 8:11579 (R:US)
Hazards
Ground-water problems in open-pit and underground mines, 8:11740 (J:US)
Hydrology
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Land Reclamation
Evaluation of environmental issues on the use of peat as an energy source, 8:11690 (RA:US)
Lignite in Europe: use, present and future production, 8:11735 (RA:US)
Mine Draining
Lignite in Europe: use, present and future production, 8:11735 (RA:US)
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Mine Haulage
Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA:US)
Mining Equipment
Comprehensive use of peat in the USSR, 8:11727 (RA:US)
Conceptual designs for peat production systems, 8:11728 (RA:US)
Lignite in Europe: use, present and future production, 8:11735 (RA:US)
Low-rank coal exploitation and utilization in east European countries, 8:11734 (RA:US)
Power shovel data accumulator and display. Final report, September 1982, 8:11733 (R:US)
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Testing of sod peat equipment and elucidation of sod dewatering characteristics, 8:11729 (RA:US)
Planning
Testing of sod peat equipment and elucidation of sod dewatering characteristics, 8:11729 (RA:US)
Slope Stability
Ground-water problems in open-pit and underground mines, 8:11740 (J:US)

SURFACE WATERS
See also COASTAL WATERS
ESTUARIES
STREAMS
Geochemical Surveys
Hydrochemical and stream sediment detailed geochemical survey for Kettle Falls and Mcinite Mine Areas, Washington, 8:11837 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Phoenix quadrangle, Arizona. Uranium Resource Evaluation Project, 8:11830 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Idaho Falls quadrangle, Idaho. Uranium Resource Evaluation Project, 8:11836 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Fresno and Death Valley quadrangles, California; Nevada. Uranium Resource Evaluation Project, 8:11832 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Adel, Jordan Valley, and Twin Falls quadrangles, Oregon; Idaho. Uranium Resource Evaluation Project, 8:11834 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Caliente, Lund, Ely, and Elko Quadrangles, Nevada; Utah, 8:11833 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for San Luis Obispo and Santa Cruz Quadrangles, California, 8:11831 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Hailey and Challis Quadrangles, Idaho, 8:11835 (R:US)

SURFACE-ACTIVE AGENTS
See SURFACTANTS

SURFACTANTS
Dissolution
Interfacial phenomena in enhanced oil recovery, 8:11799 (B:US)
Phase Studies
Ultra-low IFT, phase behavior and microstructure in oil/brine/surfactant/alcohol systems, 8:11802 (J:US)
Precipitation
Interfacial phenomena in enhanced oil recovery, 8:11799 (B:US)

SURVEILLANCE (RADIOACTIVITY)
See RADIATION MONITORING

SURVEY (RADIOACTIVITY)
See RADIATION MONITORING

SUSPENSIONS (FUEL)
See FUEL SLURRIES

SWEAT GLANDS
See SKIN

SWEDEN
Methanol Plants
Methanol from wood and peat, 8:11989 (RA:US)

SWEDISH ORGANIZATIONS
Research Programs
Annual report, 1981. Cosmic and subatomic physics, elementary particle physics, mathematical physics, and theoretical high energy physics, 8:13226 (R:SE)

SWIRL FLOW
See VORTEX FLOW

SYMMETRY BREAKING
Research in elementary-particle physics. Progress report, May 1, 1982-April 30, 1983, 8:13250 (R:US)

SYMPLECTIC GROUPS
See SP GROUPS

SYNCHROPHASOTRONS
See SYNCHROTRONS

SYNCHROTRON RADIATION
Biological Radiation Effects
Experiment control and data-acquisition system for the biology small-angle x-ray-scattering station, 8:12939 (R:US)
SYNCHROTRON RADIATION SOURCES
See also NSLS
X-Ray Diffractometers
High-resolution x-ray scattering, 8:12913 (R:US)
SYNCHROTRONS
See also BROOKHAVEN AGS
FERMILAB ACCELERATOR
JINR SYNCHROTRON
KEK SYNCHROTRON
NSLS
SATURNE
Particle Boosters
FORTRAN preprocessor in the booster synchrotron control system, 8:12918 (R:SU:In Russian)
SYNCRUDE
See SYNTHETIC PETROLEUM
SYNROC
See SYNTHETIC ROCKS
SYNTHESIS GAS
Chemical Reaction Yield
Pressurized oxygen blown fluidized bed gasification of wood, 8:11967 (RA:US)
Hydrogenation
Liquid-hydrocarbon fuels from syngas. First annual report, March 1981-February 1982, 8:11962 (R:US)
Production
Investigation of gasification of biomass in the presence of catalysts, 8:12067 (R:US)
State of the art: steam hydrocarbon reforming, 8:11955 (RA:US)
Thagard high-temperature fluid-wall reactor for syngas generation from biomass, 8:12091 (RA:US)
Synthesis
Pressurized fluidized bed gasifier in the synthesis of methanol from wood, 8:11988 (RA:US)
SYNTHETASES
See LIGASES
SYNTHETIC CRUDE OIL
See SYNTHETIC PETROLEUM
SYNTHETIC FUELS
See also ALCOHOL FUELS
SYNTHETIC PETROLEUM
Chemical Spills
Evaporation of phenols from synthetic liquid fuel spills, 8:13082 (J:GB)
Combustion Products
Soot formation in synthetic-fuel droplets. Eighth quarterly technical progress report, July 1-September 30, 1982, 8:11961 (R:US)
Commercialization
Coal liquids: milestones toward commercialization, 8:11591 (RA:US)
Potential for commercial synthetic fuels in the US energy future, 8:12492 (RA:US)
Cost
Synthetic fuel costs vs oil price (Forecasting; graph shows dependence of copper, aluminum, steel, CE index, CMR index, cement and coal prices on oil prices), 8:11776 (RA:US)
When should you build a synthetic fuel plant, 8:11777 (RA:US)
Economic Analysis
Synthetic fuel costs vs oil price (Forecasting; graph shows dependence of copper, aluminum, steel, CE index, CMR index, cement and coal prices on oil prices), 8:11776 (RA:US)
Economics
Potential for commercial synthetic fuels in the US energy future, 8:12492 (RA:US)
Synthetic fuel costs vs oil price (Forecasting; graph shows dependence of copper, aluminum, steel, CE index, CMR index, cement and coal prices on oil prices), 8:11776 (RA:US)
Environmental Impacts
Comparative assessment of the environmental and health effects associated with selected synthetic and alcohol fuel production/conversion technologies, 8:12032 (RA:BR)
Feasibility Studies
Outlook for coal synthetics: time for re-appraisal and resolve, 8:11597 (RA:US)
Forecasting
Maintaining automotive mobility: using fuel economy and synthetic fuels to compete with OPEC oil. Final report, 8:12612 (R:US)
Market
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Marketing Research
On-farm use of biomass fuels: market penetration potential during normal and fuel-emergency conditions, 8:12065 (R:US)
Planning
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Technology Assessment
Alternative fuels - where we are today and where we need to go: status of technology, issues, requirements for R and D, 8:12586 (RA:US)
Comparative assessment of the environmental and health effects associated with selected synthetic and alcohol fuel production/conversion technologies, 8:12032 (RA:BR)
SYNTHETIC FUELS CORPORATION
Bottom line: can we finance major synfuels construction in the '80's, 8:11774 (RA:US)
How industry views the climate for major synfuels investment in the 80's, 8:11772 (RA:US)
Planning
Synthetic Fuels Corporation progress to date with indications for the future, 8:12485 (RA:US)
SYNTHETIC FUELS INDUSTRY
Shape and pace of the United Staes synthetic fuels industry, 8:11779 (RA:US)
Feasibility Studies
Outlook for synthetic fuels, 8:12496 (RA:US)
Potential for commercial synthetic fuels in the US energy future, 8:12492 (RA:US)
Financial Incentives
Financing a synthetic fuels plant, 8:12495 (RA:US)
Outlook for synthetic fuels, 8:12496 (RA:US)
Synthetic Fuels Corporation progress to date with indications for the future, 8:12485 (RA:US)
Synthetic fuels industry in Germany 1927 to 1945, 8:11778 (RA:US)
Financing
Commercialization status - DOE programs, 8:11786 (RA:US)
Financing a synthetic fuels plant, 8:12495 (RA:US)
Forecasting
How industry views the climate for major synfuels investment in the 80's, 8:11772 (RA:US)
Synthetic fuels: past performance and future plans, 8:12493 (RA:US)
Investment
How industry views the climate for major synfuels investment in the 80's, 8:11772 (RA:US)
Market
Commercialization status - DOE programs, 8:11786 (RA:US)
Recommendations
Synthetic fuels from coal: our moral equivalent of war, 8:11775 (RA:US)
Synthetic fuels: past performance and future plans, 8:12493 (RA:US)
Risk Assessment
Financing a synthetic fuels plant, 8:12495 (RA:US)
Potential for commercial synthetic fuels in the US energy future, 8:12492 (RA:US)
Site Selection
Outlook for synthetic fuels, 8:12496 (RA:US)
Socio-Economic Factors
Outlook for synthetic fuels, 8:12496 (RA:US)
Water Requirements
Outlook for synthetic fuels, 8:12496 (RA:US)

SYNTHETIC NATURAL GAS
See HIGH BTU GAS
SYNTHETIC PETROLEUM
Chemical Analysis
Laser excited Shpol'skii spectroscopy for the selective excitation and determination of polynuclear aromatic hydrocarbons, 8:12758 (R:US)
SYNTHETIC ROCKS
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Corrosion Resistance
Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance, 8:11867 (R:US)
Leachates
Electrical-conductivity measurements of leachates for the rapid assessment of wasteform corrosion resistance, 8:11867 (R:US)
Leaching
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
SYNTHINE PROCESS
See FISCHER-TROPSCH SYNTHESIS
SYSTEM FAILURE ANALYSIS
See also FAULT TREE ANALYSIS
Elements of methodology for study the failures of great systems. Logical and algebraic calculus, 8:13540 (R:FR:In French)

T

TACHYONS
Shape
Shape of tachyons, 8:13406 (R:IT)
TAILINGS
Solid residue separated in the preparation of various products.
See also MILL TAILINGS
Chemical Composition
Geochemistry of leachates from selected coal mining and combustion wastes. Project completion report, July 1977-September 1979, 8:11692 (R:US)
TAIWAN
Energy Consumption
Fuel-cell technology assessment. Volume IV. Evaluation of Taiwan, 8:12529 (R:US)
Power Generation
Fuel-cell technology assessment. Volume IV. Evaluation of Taiwan, 8:12529 (R:US)
TANDEM ELECTROSTATIC ACCELERATORS
Prior to February 1979,information was indexed to Van de Graaff Accelerators.
Progress report, September 1, 1981-August 31, 1982, 8:13294 (R:US)
Ion Microprobe Analysis
Sandia nuclear microprobe, 8:12931 (R:US)
Magnetic Analyzers
Energy calibration of the TUNL dual-90° magnet analyzing system, 8:12915 (R:US)
TANDEM MIRROR DEVICES
See TMR REACTORS
TMX DEVICES
TANDEM MIRROR TYPE REACTORS
See TMR REACTORS
TANK FARMS
See STORAGE FACILITIES
TANKER SHIPS
Accidents
Flare system for safe disposal of LNG from a disabled tanker, 8:13080 (R:US)
TANKS
Inspection
Savannah River Plant waste-tank inspection manual, 8:11881 (R:US)
Leak Testing
Savannah River Plant waste-tank inspection manual, 8:11881 (R:US)
TANTALUM
Diffusion
Chemical diffusion of Ta in γ-U in samples fabricated for positron studies, 8:12694 (J:NL)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
TANTALUM COMPLEXES
Chemical Preparation
Metal-metal-bonded complexes of the early transition metals. 4. Synthesis and characterization of the tantalum (II) dimer $Ta_2Cl_6(PMe_3)_4$, 8:12796 (J:US)
Structural Chemical Analysis
Metal-metal-bonded complexes of the early transition metals. 4. Synthesis and characterization of the tantalum (II) dimer $Ta_2Cl_6(PMe_3)_4$, 8:12796 (J:US)
TARTRATES
Ion Exchange Chromatography
Applications of ion chromatography, 8:12747 (R:US)
TAU LEPTONS
See TAU PARTICLES
TAU PARTICLES
Weak Particle Decay
Measurement of the tau lifetime, 8:13266 (R:US)
TAUONS
See TAU PARTICLES
TBP
Radioactive Waste Processing
Removal of solubilized solvent extractants from aqueous waste streams, 8:11919 (J:JP)
TEARING INSTABILITY
Linear theory of electromagnetic instabilities in plasmas with a hollow q-profile, 8:13453 (J:AT)
TECHNETIUM
Precipitation
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Solubility
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
TECHNETIUM 93
Energy-Level Density
Parameter of nuclear level density spin dependence in the range A approximately 100, 8:13332 (RA:SU:In Russian)
TECHNETIUM 95
Diffusion
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Energy-Level Density
Parameter of nuclear level density spin dependence in the range A approximately 100, 8:13332 (RA:SU:In Russian)
TECHNETIUM 99
Excretion
Enhancement of radiopharmaceutical excretion by chemical interventions, 8:13176 (R:US)
TELLURIUM
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
TELLURIUM 124
Multipole Transitions
Effect the residual force spin components on the properties of the electrical type states in the spherical nuclei, 8:13326 (RA:SU:In Russian)
TEM
See ALKYLATING AGENTS
TEMPERATURE (0065-0273 K)
See LOW TEMPERATURE
TEMPERATURE (AMBIENT)
See AMBIENT TEMPERATURE

TEMPERATURE CONTROL
Technology Assessment
Survey of the international development in indoor climate control, 8:12564 (R:US)
TEMPERATURE DEPENDENCE
Nocturnal Variations
Simple nocturnal slope-flow data from the Rattlesnake Mountain site, 8:13023 (R:US)
TENNESSEE
Coal Deposits
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
TENNESSEE VALLEY AUTHORITY
Planning
Tennessee Valley Authority's atmospheric fluidized bed combustion program, 8:11759 (RA:US)
TERBIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
TERRESTRIAL ECOSYSTEMS
See also RANGELANDS
Computerized Simulation
Long-term dynamics of forest ecosystems, 8:13056 (J:US)
Radionuclide Migration
Stack-released plutonium in the terrestrial environment of a chemical separations facility, 8:13067 (J:US)
TERTIARY RECOVERY
See ENHANCED RECOVERY
TEST FACILITIES
Fuel-rod vibration in two-phase flow (BWR), 8:12291 (R:US)
LOCA simulation in NRU program. Data report for thermal-hydraulic experiment 2 (TH-2) (PWR; BWR), 8:12411 (R:US)
Design
Pressure-shear loading techniques for material-property studies, 8:12882 (R:US)
Tonopah Test Range capabilities: technical manual, 8:13014 (R:US)
Operation
Pressure-shear loading techniques for material-property studies, 8:12882 (R:US)
Tonopah Test Range capabilities: technical manual, 8:13014 (R:US)
TESTING
Standardization
Peat testing standardization, 8:11666 (RA:US)
TETRACENE
Physical Radiation Effects
Nonphotochemical hole burning and the nature of amorphous solids, 8:12737 (R:US)
TEXACO GASIFICATION PROCESS
Turn in the road: Eastman chemicals from coal, 8:11596 (RA:US)
Commercialization
Commercializatin of the Texaco coal gasification process, 8:11588 (RA:US)
Demonstration Plants
Commercializatin of the Texaco coal gasification process, 8:11588 (RA:US)
Mathematical Models
Simulation of a Texaco gasifier. Volume 2: an unsteady-state model. Final report, 8:11648 (R:US)
Modifications
Large wood to methanol plants, 8:11987 (RA:US)
Pilot Plants
Commercializatin of the Texaco coal gasification process, 8:11588 (RA:US)
TEXAS
Air Quality
Acid deposition in Texas: technical summary and perspective. Final report, 8:13033 (R:US)
Plan to evaluate acid-deposition issues in the state of Texas. Final report, 8:13032 (R:US)
Aquifers
Groundwater-source heat-pump design development for Texas. Volume I. Resource. Final report, 8:12571 (R:US)
Coal Deposits
Policy and planning for the development of deep basin lignite on the Gulf Coast, 8:11726 (RA:US)
Status of Gulf Coast lignite activity, 8:11721 (RA:US)
Coal Reserves
Policy and planning for the development of deep basin lignite on the Gulf Coast, 8:11726 (RA:US)
Economic Development
Input-output and risk analysis for a regional energy-development bank. Final report, 8:12467 (R:US)
Energy Demand
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Energy Policy
Feasibility analysis of a regional energy-development bank. Final report, 8:12463 (R:US)
Texas Energy Development Fund. Volume II. Administration plan, 8:12512 (R:US)
Energy Source Development
Community-Level Impacts Projection System (CLIPS). Final report, 8:12462 (R:US)
Energy Sources
Texas Energy Development Fund. Volume I. Perspectives for RD & D, 8:12511 (R:US)
Geothermal Energy
Texas geothermal R D & D program planning support document. Final report, 8:12183 (R:US)
Government Policies
Policy and planning for the development of deep basin lignite on the Gulf Coast, 8:11726 (RA:US)
Industrial Plants
Prospects for industrial lignite use along the Gulf Coast, 8:12273 (RA:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Magnetic Surveys
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11841 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11839 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11840 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11842 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11838 (R:US)
Radiation Monitoring
Aerial radiological survey of the Comanche Peak Steam Electric Station and surrounding area, Glen Rose, Texas. Date of Survey: March 1982, 8:13039 (R:US)
Radiometric Surveys
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11841 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11839 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11840 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11842 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11838 (R:US)
Renewable Energy Sources
Texas Energy Development Fund. Volume II. Administration plan, 8:12512 (R:US)
Texas Energy Development Fund. Volume I. Perspectives for RD & D, 8:12511 (R:US)

Research Programs
Texas Energy Development Fund. Volume II. Administration plan, 8:12512 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
Uranium Deposits
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11841 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11839 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11840 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11842 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11838 (R:US)

TEXAS EXPERIMENTAL TOKAMAK
See TEXT DEVICES

TEXT DEVICES
Energy Storage
TEXT energy-storage system, 8:13464 (R:US)

TFTR REACTORS
Radioactivation
Systematic investigtion of material activation on the TFTR, 8:13511 (J:US)
Thermonuclear Ignition
An FRTP fusion ignition experiment, 8:13522 (J:US)
X-Ray Spectrometers
Design philosophy for high-resolution rate and throughput spectroscopy systems, 8:13443 (R:US)

THALLIUM
Activation Analysis
Activation of Tl, Pb and Bi by 10-160 MeV neutrons: possible application to the analysis of Bi, 8:12769 (J:CH)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

THALLIUM 201
Excretion
Enhancement of radiopharmaceutical excretion by chemical interventions, 8:13176 (R:US)

THALLIUM 205
Energy Levels
Effective interaction and structure of odd spherical nuclei, 8:13346 (RA:SU:In Russian)

THE GEYSERS
See GEYSERS GEOTHERMAL FIELD

THERMAL CONDUCTION
Computer Calculations
COYOTE: a finite-element computer program for nonlinear heat-conduction problems, 8:12870 (R:US)

THERMAL ENERGY STORAGE EQUIPMENT
Design
High-temperature integrated thermal-energy-storage system for solar-thermal applications. Final subcontract report, 8:12181 (R:US)
Economic Analysis
High-temperature integrated thermal-energy-storage system for solar-thermal applications. Final subcontract report, 8:12181 (R:US)
Engineering Drawings
Pilot-plant station manual (RADL Item 2-1). Volume III. Equipment data. 10-MWe solar-thermal central-receiver pilot plant: solar-facilities design integration, 8:12121 (R:US)
Feasibility Studies
Aquifier thermal energy storage: a survey, 8:12453 (J:US)
Slags
High-temperature integrated thermal-energy-storage system for solar-thermal applications. Final subcontract report, 8:12181 (R:US)
Specifications
Pilot-plant station manual (RADL Item 2-1). Volume III. Equipment data. 10-MWe solar-thermal central-receiver pilot plant: solar-facilities design integration, 8:12121 (R:US)

THERMAL INSULATION
Density
In-situ study of attic loose-fill thermal insulation in residential application, 8:12558 (R:US)
Depth
In-situ study of attic loose-fill thermal insulation in residential application, 8:12558 (R:US)

THERMAL POLLUTION (AIR)
See AIR POLLUTION

THERMAL POWER PLANTS
See also COMBINED-CYCLE POWER PLANTS
FOSSIL-FUEL POWER PLANTS
GEOTHERMAL POWER PLANTS
NUCLEAR POWER PLANTS
OCEAN THERMAL POWER PLANTS
REFUSE-FUELED POWER PLANTS
SOLAR THERMAL POWER PLANTS
Cooling Systems
Environmental evaluation of European power plant cooling systems: a polish research project, 8:12279 (R:US)
Cooling Towers
Waste-heat vertical tube foam evaporation for cooling tower blowdown renovation/recycle. Project summary report, 8:12277 (R:US)
Health Hazards
Ohio River Basin energy study: health aspects, 8:12284 (R:US)
Heat Recovery Equipment
Waste-heat vertical tube foam evaporation for cooling tower blowdown renovation/recycle. Project summary report, 8:12277 (R:US)

THERMAL REACTORS
See also ANGRA-1 REACTOR
ANGRA-2 REACTOR
AVR REACTOR
KNK REACTOR
KUOSHENG-1 REACTOR
KUOSHENG-2 REACTOR
LINGEN REACTOR
MZFR REACTOR
OBRIGHEIM REACTOR
OYSTER CREEK-1 REACTOR
PALISADES-1 REACTOR
RWE-BAYERNWERK REACTOR
SALEM-2 REACTOR
SAN ONOFRE-3 REACTOR
SEQUOYAH-1 REACTOR
SEQUOYAH-2 REACTOR
STADE REACTOR
THREE MILE ISLAND-1 REACTOR
THREE MILE ISLAND-2 REACTOR
TURKEY POINT-3 REACTOR
VAK REACTOR
WNP-2 REACTOR
WPIR REACTOR
WUERGASSEN REACTOR
ZION-2 REACTOR
Control Elements
Sensitivity of control times in function of core parameters and oscillations control in thermal nuclear systems, 8:12361 (R:BR:In Portuguese)

THERMAL WATERS
Chemical Composition
Chemical analyses of waters from springs and wells in the Clear Lake volcanic area, 8:12209 (RA:US)
Chemical composition of water and gas from five nearshore subaqueous springs in Clear Lake, 8:12213 (RA:US)

THERMIONIC CELLS
See THERMIONIC CONVERTERS

THERMIONIC CONVERTERS
High-Frequency Heating
Cesium-plasma-conductivity enhancement in the advanced thermionic energy converter. Final report, 8:12517 (R:US)
Laser-Radiation Heating
Cesium-plasma-conductivity enhancement in the advanced thermionic energy converter. Final report, 8:12517 (R:US)
Thermionic Emitters
Preliminary investigations of thermionic converters utilizing HOTEMA and DFVLR electrodes, 8:12519 (R:US)

THERMIONIC EMITTERS
Fabrication
Preliminary investigations of thermionic converters utilizing HOTEMA and DFVLR electrodes, 8:12519 (R:US)

Performance Testing
Preliminary investigations of thermionic converters utilizing HOTEMA and DFVLR electrodes, 8:12519 (R:US)
THERMIONIC GENERATORS
See THERMIONIC CONVERTERS
THERMOCHEMICAL PROCESSES
See also COMBUSTION
GASIFICATION
Environmental Impacts
Biomass energy systems: status of environmental, health and safety investigations, 8:12047 (R:US)
THERMODYNAMICS
Computer Calculations
Entry format for representation of analytical relations on the ES computer, 8:13549 (R:SU:In Russian)
THERMOELECTRIC CELLS
See THERMOELECTRIC GENERATORS
THERMOELECTRIC CONVERTERS
See THERMOELECTRIC GENERATORS
THERMOELECTRIC GENERATORS
Quality Assurance
Quality assurance program for isotopic power systems, 8:12518 (R:US)
Radioisotope Heat Sources
Quality assurance program for isotopic power systems, 8:12518 (R:US)
Regeneration
Electrochemistry applied to thermal conversion, 8:12092 (R:US)
THERMOLUMINESCENCE
Kinetics
Characteristics of thermoluminescence glow curves for materials exhibiting more than one glow peak, 8:12818 (R:US)
THERMOLUMINESCENT DOSEMETERS
NRC TLD direct radiation monitoring network. Progress report, April-June 1982, 8:12367 (R:US)
Comparative Evaluations
Evaluation of experiences in long-term radon and radon-daughter measurements, 8:13044 (R:US)
Results of an inquiry concerning experience gained in the use of thermoluminescent and phosphate glass dosemeters, 8:12952 (RA:DE:In German)
Performance
Dosimetric characteristics and radiation monitoring with $CaSO_4$(Dy):NaCl pellets, 8:12966 (R:BR)
THERMOLUMINESCENT DOSIMETRY
Calibration Standards
Calibration of TLD-readers with standard light sources, 8:12954 (RA:DE:In German)
Data Processing
State of the art in thermoluminescent dosimetry using dosemeters with automated read-out, 8:12953 (RA:DE:In German)
Recording Systems
State of the art in thermoluminescent dosimetry using dosemeters with automated read-out, 8:12953 (RA:DE:In German)
THERMONUCLEAR DEVICES
Neutron Spectra
Neutron physics. Pt. 4, 8:13435 (R:SU:RU)
Power Supplies
Testing of sliding electrical contacts for homopolar generators, 8:13470 (R:US)
Superconducting Magnets
Superconducting magnets for fusion, 8:13503 (J:AT)
THERMONUCLEAR FUELS
Neutronic Damage Functions
Tritium-tritium fusion: blanket neutronics and photonics, 8:13513 (J:US)
THERMONUCLEAR REACTOR MATERIALS
Annealing
Defect production in simulated cascades: cascade quenching and short-term annealing, 8:13481 (R:US)
Defects
Defect production in simulated cascades: cascade quenching and short-term annealing, 8:13481 (R:US)
Neutron Reactions
Summary of measurements and calculations of neutron and gamma-ray emission spectra from spheres pulsed with 14-MeV neutrons, 8:13378 (R:US)
Permeability
Tritium permeation scoping test, 8:13486 (R:US)
Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)
THERMONUCLEAR REACTORS
For use in cases where certain aspects of either hypothetical or real thermonuclear reactors are discussed.
See also TOKAMAK TYPE REACTORS
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R:US)
Alpha Detection
Nuclear diagnostic for fast alpha particles, 8:13448 (R:US)
Engineering
Future engineering needs of magnetic fusion, 8:13473 (R:US)
Radiation Streaming
Streaming of 14-MeV neutrons through an iron duct: comparison of measured neutron and gamma-ray energy spectra with results calculated using the Monte Carlo code MCNP, 8:13492 (R:US)
Tritium Recovery
Maximum tritium production in toroidal fusion reactors with no inboad breeding, 8:13518 (J:US)
THERMONUCLEAR WEAPONS
See NUCLEAR WEAPONS
THERMOPHOTOVOLTAIC CONVERTERS
Feasibility Studies
Thermophotovoltaic conversion from conventional heat sources. Final report, 8:12546 (R:US)
THETA PINCH
Plasma Waves
Wave and plasma heating, 8:13425 (RA:DE:In German)
Waves and plasmaheating, 8:13430 (RA:DE:In German)
THIO COMPOUNDS
See ORGANIC SULFUR COMPOUNDS
THIOETHERS
See SULFIDES
THIONAPHTHENES
Molecular Structure
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R:US)
Monoclinic Lattices
Crystal and molecular structures of selected ruthenium (II) phosphate complexes and vinyl bromide-benzothiophene adducts, 8:12807 (R:US)
THORIUM
Activation Analysis
Determination of uranium and thorium in semiconductor memory materials by high fluence neutron activation analysis, 8:12766 (J:CH)
Cathodoluminescence
Cathodoluminescence of thorium in the presence of O_2, CO and gas mixtures of CO-O_2 and CO-H_2, 8:12695 (J:NL)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
THORIUM 232
Energy Levels
^{238}U and ^{232}Th levels excited in the (n, n') reactions with 3 MeV neutrons, 8:13352 (RA:SU:In Russian)
THORIUM 232 TARGET
Neutron Reactions
^{238}U and ^{232}Th levels excited in the (n, n') reactions with 3 MeV neutrons, 8:13352 (RA:SU:In Russian)

THORIUM COMPLEXES
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
THORIUM D
See LEAD 208
THORIUM HYDRIDES
Phase Studies
Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen, and vanadium alloys, 8:12712 (R:US)
THORIUM NITRIDES
Phase Studies
Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen, and vanadium alloys, 8:12712 (R:US)
THREE MILE ISLAND-1 REACTOR
Computerized Simulation
Iterative solution to the optimal control of depletion problem in pressurized water reactors, 8:12310 (D:US)
Steam Generators
Response to questions raised concerning TMI-2 cleanup schedule and cost, 8:12393 (R:US)
THREE MILE ISLAND-2 REACTOR
Decontamination
Response to questions raised concerning TMI-2 cleanup schedule and cost, 8:12393 (R:US)
Personnel
Technical assessment of radiation overexposures at Three Mile Island from the August 28, 1979, entry into the Unit 2 Fuel-Handling Building Makeup Valve Room, 8:12389 (R:US)
Radiation Hazards
Technical assessment of radiation overexposures at Three Mile Island from the August 28, 1979, entry into the Unit 2 Fuel-Handling Building Makeup Valve Room, 8:12389 (R:US)
Radioactive Waste Processing
Feasibility of vitrifying EPICOR II organic resins, 8:12394 (R:US)
Reactor Accidents
Feasibility of vitrifying EPICOR II organic resins, 8:12394 (R:US)
THREE-BODY PROBLEM
Harmonic Oscillators
Three-particle relativistic harmonic dynamics in the constraint formalism, 8:13279 (R:JP)
THRUSTERS
Research Programs
Research needs: prime-power for high energy space systems. Final report 26 Oct 81-31 Jul 82, 8:12381 (R:US)
THULIUM
Auger Effect
Auger KMM transitions of thulium arising in $_{70}169$Yb decay, 8:13239 (RA:SU:In Russian)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
THULIUM 167
E1-Transitions
Matrix elements of penetration of the K forbidden ($\Delta K=3$) E1-transitions, 8:13342 (RA:SU:In Russian)
THULIUM 169
E1-Transitions
Matrix elements of penetration of the K forbidden ($\Delta K=3$) E1-transitions, 8:13342 (RA:SU:In Russian)
THULIUM 171
E1-Transitions
Matrix elements of penetration of the K forbidden ($\Delta K=3$) E1-transitions, 8:13342 (RA:SU:In Russian)
THULIUM BROMIDES
Crystal Structure
Investigations on the structure and polymorphy of the dibromides of dysprosium, thulium, ytterbium and calcium, 8:12781 (R:DE:In German)
TIGHT SANDS
See SANDSTONES
TIME PROJECTION CHAMBERS
See PROJECTION SPARK CHAMBERS
TIN
Emission Spectroscopy
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Gas Chromatography
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Neutron Reactions
Fast-neutron elastic-scattering cross sections of elemental tin, 8:13320 (R:US)
TIN 120 TARGET
Nitrogen 14 Reactions
Isotopic separation device on-line with a heavy ion accelerator, 8:12926 (R:FR:In French)
TIN ALLOYS
Fabrication
Materials research for hydrogen-cooled superconducting power-transmission lines (SPTL). Part I. Liquid hydrogen as a dielectric. Part II. Superconducting materials. Annual report, January 1, 1981-December 31, 1981 (Nb_3Ge), 8:12668 (R:US)
Young Modulus
Effects of ternary additions on Young's modulus and the martensitic transformation of Nb_3Sn (Effects of Ta, Ti, Zr), 8:12659 (R:US)
TIN OXIDES
Absorptivity
Optimization of transparent electrode for solar cell. Technical report, 15 September 1981-14 September 1982, 8:12094 (R:US)
Chemical Vapor Deposition
Optimization of transparent electrode for solar cell. Technical report, 15 September 1981-14 September 1982, 8:12094 (R:US)
Electric Conductivity
Optimization of transparent electrode for solar cell. Technical report, 15 September 1981-14 September 1982, 8:12094 (R:US)
Photoconductivity
Dynamic aspects of the dye-sensitized photoconductivity of semiconductors. Technical progress report, April 1, 1981-March 31, 1983, 8:12733 (R:US)
TIRES
Manufacturing
Energy utilization in tire manufacturing. Final report, 8:12619 (R:US)
TISSUES
Radiochemical Analysis
US Uranium Registry tissue program, 8:12828 (BA:US)
Radionuclide Kinetics
Fission of natural uranium in tumor and normal tissue, 8:13173 (TJ:US)
TITANATES
Specific compounds, except those of significance to energy research and development, should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Electrical Properties
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
Grain Orientation
Orientation of ceramic microstructures by hot-forming methods (Bi_2WO_6, Bi_2MoO_6, $PbBi_2Nb_2O_9$, $Bi_4Ti_3O_{12}$), 8:12707 (R:US)
TITANIUM
Absorption Spectroscopy
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)
Activation Analysis
Leach rate measurements from SYNROC using neutron activation analysis, 8:12762 (J:CH)

Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Oxidation
Protective oxide films. Progress report, 8:12665 (R:US)

TITANIUM 44
Collective Excitations
Microscopic description of collective excitations of the ^{44}Ti nuclei in generalized hyperspherical function method, 8:13318 (RA:SU:In Russian)
Giant Resonance
Microscopic description of collective excitations of the ^{44}Ti nuclei in generalized hyperspherical function method, 8:13318 (RA:SU:In Russian)

TITANIUM 50
Corrosion Resistance
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)

TITANIUM ALLOYS
See also TITANIUM BASE ALLOYS
Atom Transport
Hydrogen and deuterium diffusion in vanadium alloys (Containing Ti or Nb), 8:12676 (R:US)
Phase Transformations
Effect of stress on the transformation in nickel-titanium, 8:12677 (R:US)
Physical Radiation Effects
Formation of helium-gas bubbles in the vanadium-titanium binary and ternary alloys irradiated by energetic Ni^{++} ions (Preimplanted with helium ions), 8:12674 (R:US)
Shape Memory Effect
Effect of stress on the transformation in nickel-titanium, 8:12677 (R:US)
Stability
Stability of NbTi composite superconductors of high CU/SC-ratio, 8:12848 (R:DE:In English)

TITANIUM BASE ALLOYS
Corrosion
Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments, 8:12687 (R:US)
Some effects of microstructure and chemistry on corrosion and hydrogen embrittlement of TiCode-12 (Corrosion-resistant overpack/canister alloy), 8:12688 (R:US)
Crack Propagation
Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments, 8:12687 (R:US)
Crevice Corrosion
Container assessment: corrosion study of HLW container materials. Quarterly progress report, January-March 1982, 8:12686 (R:US)
Fatigue
Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments, 8:12687 (R:US)
Hydrogen Embrittlement
Some effects of microstructure and chemistry on corrosion and hydrogen embrittlement of TiCode-12 (Corrosion-resistant overpack/canister alloy), 8:12688 (R:US)
Strain Rate
Investigation of environmentally assisted fracture of metallic nuclear-waste-package barrier materials in simulated basalt repository environments, 8:12687 (R:US)

TITANIUM CARBIDES
Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)

TITANIUM COMPOUNDS
See also TITANATES
TITANIUM CARBIDES
TITANIUM HYDRIDES
TITANIUM OXIDES
Structural Chemical Analysis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)
Synthesis
Metal clusters and extended metal-metal bonding in metal oxide systems, 8:12783 (R:US)

TITANIUM HYDRIDES
Phase Studies
Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen, and vanadium alloys, 8:12712 (R:US)

TITANIUM OXIDES
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
Plasma Arc Spraying
Characterization of imperfections in plasma-sprayed titania, 8:12708 (R:US)
Structural Chemical Analysis
Protective oxide films. Progress report, 8:12665 (R:US)
Surface Properties
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R:US)

TLD (DOSEMETERS)
See THERMOLUMINESCENT DOSEMETERS

TLD (DOSIMETRY)
See THERMOLUMINESCENT DOSIMETRY

TLD SYSTEMS
See THERMOLUMINESCENT DOSEMETERS

TMR REACTORS
Design
Mirror advanced reactor study (MARS), 8:13468 (R:US)
Remote Handling
Remote systems requirements for tandem-mirror fusion power reactors, 8:13531 (J:US)
Sensitivity Analysis
Cross-section sensitivity analysis for a tandem mirror hybrid reactor and considerations regarding new ^{9}Be (n, 2n) cross-section evaluations, 8:13520 (J:US)

TMX DEVICES
Energy and technology review, 8:11663 (R:US)
ECR Heating
Monte Carlo studies of tandem-mirror plasmas interacting with waves in the ion-cyclotron range of frequencies (ICRF). Progress report, October 1, 1982-December 31, 1982, 8:13422 (R:US)
Theoretical aspects of mirror fusion. Progress report, 1 October 1982-31 December 1982, 8:13421 (R:US)
Parametric Instabilities
Theoretical aspects of mirror fusion. Progress report, 1 October 1982-31 December 1982, 8:13421 (R:US)
Plasma Confinement
Understanding tandem mirror devices, 8:13451 (RA:US)
Plasma Macroinstabilities
Understanding tandem mirror devices, 8:13451 (RA:US)
Plasma Microinstabilities
Understanding tandem mirror devices, 8:13451 (RA:US)
Remote Handling
Tandem mirror next step-remote maintenance, 8:13530 (J:US)

TOBACCO SMOKES
Metabolism
Profile analysis of organic volatiles in urine of tobacco smoke-exposed beagles, 8:13189 (J:NL)

TOKAMAK DEVICES
See also ALCATOR DEVICE
ASDEX TOKAMAK
SPHEROMAK DEVICES
TEXT DEVICES
Beta Ratio
Influence of diamagnetic drifts on critical beta in tokamaks, 8:13508 (J:AT)
Magnetic Field Ripples
Neoclassical ripple transport in tokamaks, 8:13507 (J:AT)

Neutral Atom Beam Injection
Neutral beam effects on tokamak ballooning mode stability, 8:13523 (J:GB)
Plasma Diagnostics
Diagnostics for neutral-beam-heated tokamaks, 8:13446 (R:US)
Power Supplies
Pulsed hompolar generator research at the University of Texas at Austin, 8:13469 (R:US)
Stability
Feedback stabilization of rigid axisymmetric modes in tokamaks, 8:13510 (J:AT)
TOKAMAK ETF
Remote Handling
Replacement of large torus shield sectors in ETF with remote techniques, 8:13529 (J:US)
Shields
Replacement of large torus shield sectors in ETF with remote techniques, 8:13529 (J:US)
TOKAMAK FUSION TEST REACTOR
See TFTR REACTORS
TOKAMAK TYPE REACTORS
See also DOUBLET REACTORS
INTOR TOKAMAK
PLT DEVICES
STARFIRE TOKAMAK
TFTR REACTORS
TOKAMAK ETF
Current-Drive Heating
Radio-frequency wave trajectories for current drive in tokamak reactors, 8:13447 (R:US)
ICR Heating
ICRF antenna coupling studies, 8:13478 (R:US)
Magnet Coils
Design concept for the FED poloidal field coils using an internally cooled cable superconductor, 8:13491 (R:US)
Remote Handling Equipment
Three equipment concepts for the Fusion Engineering Device, 8:13465 (R:US)
Reviews
FED-INTOR activity, 8:13480 (R:US)
Shielding
Analysis of dd fusion neutron transport in thick concrete, 8:13515 (J:US)
Superconducting Magnets
Design concept for the FED poloidal field coils using an internally cooled cable superconductor, 8:13491 (R:US)
TOSCOAL PROCESS
Economic Analysis
Application of the Toscoal process to the electric utility industry, 8:12269 (RA:US)
Flowsheets
Application of the Toscoal process to the electric utility industry, 8:12269 (RA:US)
TOTAL ENERGY SYSTEMS
Acid Electrolyte Fuel Cells
Develop and test fuel-cell-powered on-site integrated total-energy systems: Phase III, full-scale power plant development. 5th quarterly report, February-April, 1982, 8:12522 (R:US)
Distributed Collector Power Plants
Shenandoah Solar Total-Energy Project, 8:12122 (R:US)
Performance Testing
Shenandoah Solar Total-Energy Project, 8:12122 (R:US)
TOTAL SUSPENDED PARTICULATES
Monitoring
Resumption of exploratory drilling operations by Texaco, Inc.: state oil and gas lesses - PRC 2725.1 (Jade Prospect), PRC 2206.1 (Anita Prospect), PRC 2955.1 (Refugio Prospect), Santa Barbara County. Final environmental impact report, 8:13101 (R:US)
TOTAL-ABSORPTION SPECTROMETERS
See SHOWER COUNTERS
TOWER FOCUS COLLECTORS
Technology Assessment
Survey of manufacturers of solar-thermal-energy systems, 8:12179 (R:US)
TOWER FOCUS POWER PLANTS
See also BARSTOW SOLAR PILOT PLANT
Design
Field optimization for the solar repowering of an electric utility near Abilene, Texas. Final report, 8:12124 (R:US)
Thermal Energy Storage Equipment
High-temperature integrated thermal-energy-storage system for solar-thermal applications. Final subcontract report, 8:12181 (R:US)
TOXIC MATERIALS
Accidents
Joint research and development on toxic-material emergency response between ENEA and LLNL. 1982 progress report, 8:13196 (R:US)
TOXICITY
Bioassay
Applications of nuclear technologies for in-vivo elemental analysis, 8:13059 (R:US)
TPC
See PROJECTION SPARK CHAMBERS
TRACER TECHNIQUES
See also ISOTOPE DILUTION
Tracer theory with applications in geosciences. Environmental Sciences Division, Publication No. 1964, 8:13197 (R:US)
TRACK DETECTORS (DIELECTRIC)
See DIELECTRIC TRACK DETECTORS
TRACK DETECTORS (PHOTOGRAPHIC)
See PHOTOGRAPHIC FILM DETECTORS
TRACKS
See PARTICLE TRACKS
TRADESCANTIA
Radiobiology
Monitoring ambient air for mutagenicity using the higher plant Tradescantia, 8:13186 (BA:US)
TRAINS
Performance
TOFC shuttle trains vs. double trailer trucks, 8:12590 (RA:US)
TRANSFER (IN ENVIRONMENT)
See RADIONUCLIDE MIGRATION
TRANSFER (IN ORGANISM)
See RADIONUCLIDE KINETICS
TRANSIENT SPECIES
See REACTION INTERMEDIATES
TRANSIENTS
Digitizers
Fast A/D conversion and processing system based on video digitizing of oscilloscope traces. Progress report, July 1981-June 1982, 8:13006 (R:US)
TRANSITION BOILING
Heat Transfer
Study of transition boiling phenomena with saturated water at 1-4 bar, 8:12874 (D:US)
TRANSITION ELEMENT COMPLEXES
See also CHROMIUM COMPLEXES
COBALT COMPLEXES
IRIDIUM COMPLEXES
IRON COMPLEXES
MOLYBDENUM COMPLEXES
OSMIUM COMPLEXES
RUTHENIUM COMPLEXES
TANTALUM COMPLEXES
Chemical Reaction Kinetics
Preparation and characterization of ligand types intermediate in the metal catalyzed conversion of coal to methane, methanol, and higher alkanes and alcohols. Final progress report, September 1, 1978-June 30, 1982 (Transitional metal-formyl complexes; hydroxymethylidene complexes; metal α-hydroxyalkyl complexes; alkidene complexes), 8:11598 (R:US)
Molecular Structure
Halide and chalcogenide clusters of the early transition metals, 8:12784 (R:US)
TRANSITION ELEMENT COMPOUNDS
See also IRON COMPOUNDS
NICKEL COMPOUNDS
NIOBIUM COMPOUNDS
SCANDIUM COMPOUNDS
TITANIUM COMPOUNDS
YTTRIUM COMPOUNDS

Magnetic Properties
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)
Superconductivity
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)

TRANSITION ELEMENTS
See also CHROMIUM
COBALT
COPPER
HAFNIUM
IRON
MANGANESE
MOLYBDENUM
NICKEL
NIOBIUM
RHENIUM
SCANDIUM
SILVER
TANTALUM
TECHNETIUM
TITANIUM
TUNGSTEN
VANADIUM
YTTRIUM
ZIRCONIUM
Catalytic Effects
Liquid-hydrocarbon fuels from syngas. Quarterly report, March 1982-May 1982, 8:11963 (R:US)

TRANSITION METALS
See TRANSITION ELEMENTS

TRANSITION RADIATION
Structure of transition radiation of the electron bunch moving through plane screens, 8:13377 (R:SU:In Russian)

TRANSMISSION (ENERGY)
See ENERGY TRANSPORT

TRANSMISSION LINES
See POWER TRANSMISSION LINES

TRANSPORT (ENERGY)
See ENERGY TRANSPORT

TRANSPORT (GAMMA)
See PHOTON TRANSPORT

TRANSPORT (IN ORGANISMS)
See RADIONUCLIDE KINETICS

TRANSPORT INSURANCE
See INSURANCE

TRANSPORT (NEUTRON)
See NEUTRON TRANSPORT

TRANSPORT (PHOTON)
See PHOTON TRANSPORT

TRANSPORT REGULATIONS
DOT's proposed routing for radioactive material shipments, 8:12858 (J:US)

TRANSPORTATION SECTOR
Energy Conservation
Transportation energy savings from a national conservation program: a case study of Pennsylvania, 8:12602 (RA:US)
Transportation conservation: can we deliver, 8:12610 (RA:US)
Energy Consumption
Michigan energy futures: requirements to the year 2000, 8:12482 (R:US)
Transportation energy: an overview, with emphasis on New York State, 8:12584 (RA:US)
Energy Models
Overview of transportation energy methodologies, 8:12585 (RA:US)
Fuel Consumption
Intercity freight movement and energy issues, 8:12587 (RA:US)
Fuel Substitution
Alternative fuels - where we are today and where we need to go: status of technology, issues, requirements for R and D, 8:12586 (RA:US)
Government Policies
Transportation energy savings from a national conservation program: a case study of Pennsylvania, 8:12602 (RA:US)
Mathematical Models
Overview of transportation energy methodologies, 8:12585 (RA:US)

TRANSPORTATION SYSTEMS
See also BUSES
RAPID TRANSIT SYSTEMS
Comparative Evaluations
Energy efficiency: which modes, which programs, 8:12596 (RA:US)
TOFC shuttle trains vs. double trailer trucks, 8:12590 (RA:US)
Cost Benefit Analysis
Costs and benefits of energy consumption by public transit, 8:12600 (RA:US)
Energy Consumption
Effects of energy constraints on transportation systems: proceedings of the fifth national conference, 8:12582 (R:US)
Effects of urban development patterns on transportation energy use, 8:12583 (RA:US)
Energy efficiency: which modes, which programs, 8:12596 (RA:US)
Energy Demand
Energy intensity of various transportation modes, 8:12611 (RA:US)
Energy Efficiency
Costs and benefits of energy consumption by public transit, 8:12600 (RA:US)
Energy intensity of various transportation modes, 8:12611 (RA:US)
Meetings
Effects of energy constraints on transportation systems: proceedings of the fifth national conference, 8:12582 (R:US)
Socio-Economic Factors
Strategic factors influencing public investment in energy efficient mobility: load factors in vehicles, capital requirements for innovation, urban design constraints, market behavior, 8:12598 (RA:US)

TRANSURANIUM ELEMENTS
See also NEPTUNIUM
PLUTONIUM
Radiochemistry
Integrative study of the behavior of transuranic elements in the marine environment. Progress report, June 1, 1982-May 31, 1983, 8:13083 (R:US)
Research Programs
Physical-chemical studies of transuranium elements. Progress report, April 1, 1982-March 31, 1983, 8:12775 (R:US)

TRANSURANIUM WASTES
See ALPHA-BEARING WASTES

TRAUMA
See INJURIES

TRAUMATIC SHOCK
See INJURIES

TRAVELLING WAVE TUBES
Dispersion Relations
Dispersion properties of spiral deflecting systems, 8:12890 (TG:US)
Study of certain plane spiral deflecting systems of traveling-wave tubes, 8:12889 (TG:US)

TREES
See also PINES
Infrared Thermography
Appearance of irregular tree canopies in nighttime high-resolution thermal infrared imagery, 8:13058 (J:US)
Short Rotation Cultivation
Short-Rotation Woody-Crops Program. Annual progress report for 1981, 8:12066 (R:US)
Species Diversity
Short-Rotation Woody-Crops Program. Annual progress report for 1981, 8:12066 (R:US)

TRETAMINE
See ALKYLATING AGENTS

TRIBOLOGY
Meetings
Fundamentals of tribology (Book), 8:12835 (B:US)

TRIBUTYL PHOSPHATE
See TBP

TRIETHYLENEMELAMINE
See ALKYLATING AGENTS

TRITIATED COMPOUNDS
See TRITIUM COMPOUNDS

TRITIUM
Diffusion
Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium, 8:13495 (R:US)
Tritium permeation scoping test, 8:13486 (R:US)
Hypernuclei
Contribution of the S' state in Bsub(lambda)(sub(lambda)sup(3)H), 8:13298 (RA:SU:In Russian)
Neutronic Damage Functions
Tritium-tritium fusion: blanket neutronics and photonics, 8:13513 (J:US)
Radiation Monitoring
Aerial radiological survey of the Argonne National Laboratory and surrounding area, Argonne, Illinois. Date of survey: May 1977, 8:13064 (R:US)
Radioactivity
Supplemental stack-effluent monitoring at the Safety Light Corporation, Bloomsburg, Pennsylvania. Final report, 8:13037 (R:US)
Radioecological Concentration
Sediment and radionuclide transport in rivers: radionuclide transport modeling for Cattaraugus and Buttermilk Creeks, New York, 8:13090 (R:US)
Sorption
Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium, 8:13495 (R:US)
Thermonuclear Reactions
Tritium-tritium fusion: blanket neutronics and photonics, 8:13513 (J:US)
Uses
Radioisotope-powered light sources, 8:11946 (R:US)
TRITIUM COMPOUNDS
Nuclear Magnetic Resonance
NMR study of phase transitions in VT/sub 0.50/ and VT/sub 0.75/, 8:12719 (J:US)
TRITIUM RECOVERY
In thermonuclear reactors and/or devices.
Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium, 8:13495 (R:US)
Maximum tritium production in toroidal fusion reactors with no inboad breeding, 8:13518 (J:US)
Tritium control for the DEMO liquid-metal blanket design, 8:13517 (J:US)
TRITIUM TARGET
Proton Reactions
Algebraic version of resonating-group method and elastic scattering plases of the ^{3}He(n, n)^{3}He, ^{3}H(p, p)^{3}H, ^{3}H(d, d)^{3}H, 8:13299 (RA:SU:In Russian)
TRIUMF CYCLOTRON
Research Programs
TRIUMF: scientific activities annual report, 1980, 8:12929 (R:CA)
TRI-UNIVERSITY MESON FACILITY
See TRIUMF CYCLOTRON
TROMBE WALLS
Performance Testing
Trombe wall performance study in the Upper-Midwest. Final report, 8:12156 (R:US)
Retrofitting
Cooperative passive-solar commercial retrofit. Final report, September 1, 1980-December 31, 1982, 8:12155 (R:US)
Passive-solar collector: a Trombe'-wall retrofit guide, 8:12158 (R:US)
TROPOSPHERE
Remote Sensing
Planning of a C-band-pulse-Doppler-radar with polarization diversity for atmospheric research in the meso-scale range, 8:13021 (R:DE:In German)
TRU WASTES
See ALPHA-BEARING WASTES
TRUCKS
Accidents
Truck accident and fatality rates calculated from California highway accident statistics for 1980 and 1981, 8:11853 (R:US)
Fuel Economy
Intercity freight movement and energy issues, 8:12587 (RA:US)
Performance
TOFC shuttle trains vs. double trailer trucks, 8:12590 (RA:US)
TRX-1
See REVERSE-FIELD PINCH
TRYPSIN
Code number 3.4.21.4.
Biological Effects
Degradation of connective tissue matrices by macrophages. II. Influence of matrix composition on proteolysis of glycoproteins, elastin, and collagen by macrophages in culture, 8:13116 (J:US)
TSL PROCESS
Catalysts
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No. 3, 8:11631 (R:US)
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.2 (152 references), 8:11630 (R:US)
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.1, 8:11629 (R:US)
Optimization
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No. 3, 8:11631 (R:US)
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.2 (152 references), 8:11630 (R:US)
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No.1, 8:11629 (R:US)
Organic Solvents
Heavy recycle-solvent studies in two-stage coal liquefaction. Second technical progress report, October 1-December 10, 1982, 8:11643 (R:US)
Pilot Plants
Advanced coal-liquefaction-catalyst development. Quarterly progress report, No. 3, 8:11631 (R:US)
Process Development Units
Integrated two-stage liquefaction. Topical technical progress report completion of Indiana V program, April 1, 1981-September 30, 1981, 8:11618 (R:US)
TSP
See TOTAL SUSPENDED PARTICULATES
TSUKUBA KEK SYNCHROTRON
See KEK SYNCHROTRON
TUBES (CONDUITS)
See PIPES
TUFF
Compression Strength
Uniaxial and triaxial compression test series on Calico Hills tuff, 8:13219 (R:US)
Ground Water
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Permeability
Elution of radionuclides through columns of crushed rock from the Nevada Test Site, 8:11923 (R:US)
Poisson Ratio
Uniaxial and triaxial compression test series on Calico Hills tuff, 8:13219 (R:US)
Strain Rate
Uniaxial and triaxial compression test series on Calico Hills tuff, 8:13219 (R:US)
Young Modulus
Uniaxial and triaxial compression test series on Calico Hills tuff, 8:13219 (R:US)
TUMOR CELLS
Biological Radiation Effects
Comparative action spectra for pyrimidine dimer formation in Cloudman S91 mouse melanoma and EMT6 mouse mammary carcinoma cells, 8:13162 (J:GB)
Radionuclide Kinetics
Fission of natural uranium in tumor and normal tissue, 8:13173 (TJ:US)
TUMORS
See NEOPLASMS

TUNGSTEN
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Oxidation
Protective oxide films. Progress report, 8:12665 (R:US)
Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)
Surface Properties
Studies of supported metal catalysts. Progress report, September 1, 1979-August 31, 1982, 8:12776 (R:US)
TUNGSTEN 180
Energy Levels
Development of data-acquisition-and-analysis systems for in-beam gamma-ray spectroscopy: a study of the nucleus ^{180}W, 8:13343 (R:US)
TUNGSTEN SELENIDES
Electrical Properties
Electrical properties of WSe_2, WS_2, $MoSe_2$, MoS_2, and their use as photoanodes in a semiconductor/liquid junction solar cell, 8:12062 (R:US)
Hexagonal Lattices
Detailed photocurrent spectroscopy of the semiconducting group VI transition metal dichalcogenides, 8:12811 (J:US)
Photocurrents
Detailed photocurrent spectroscopy of the semiconducting group VI transition metal dichalcogenides, 8:12811 (J:US)
TUNGSTEN SULFIDES
Electrical Properties
Electrical properties of WSe_2, WS_2, $MoSe_2$, MoS_2, and their use as photoanodes in a semiconductor/liquid junction solar cell, 8:12062 (R:US)
Hexagonal Lattices
Detailed photocurrent spectroscopy of the semiconducting group VI transition metal dichalcogenides, 8:12811 (J:US)
Photocurrents
Detailed photocurrent spectroscopy of the semiconducting group VI transition metal dichalcogenides, 8:12811 (J:US)
TUNISIA
Energy Consumption
Fuel-cell technology assessment. Volume III. Evaluation of Tunisia, 8:12528 (R:US)
Power Generation
Fuel-cell technology assessment. Volume III. Evaluation of Tunisia, 8:12528 (R:US)
TUNNELING
Hazards
Ground-water problems in open-pit and underground mines, 8:11740 (J:US)
Water Influx
Ground-water problems in open-pit and underground mines, 8:11740 (J:US)
TURBINES
See also GAS TURBINES
WIND TURBINES
Performance Testing
Tests of a two-stage, axial-flow, two-phase turbine, 8:12240 (R:US)
Two-Phase Flow
Tests of a two-stage, axial-flow, two-phase turbine, 8:12240 (R:US)
TURKEY POINT-3 REACTOR
Reactor Operation
Selected safety-related events reported in May and June 1982, 8:12427 (J:US)
Reactor Safety
Selected safety-related events reported in May and June 1982, 8:12427 (J:US)
TURNOVER (RADIONUCLIDES)
See RADIONUCLIDE KINETICS
TVA
See TENNESSEE VALLEY AUTHORITY

U

UCLLL
See LAWRENCE LIVERMORE LABORATORY
U-GAS PROCESS
Materials Testing
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
Pilot Plants
Corrosion and degradation of test materials in the U-GAS coal-gasification pilot plant, 8:11651 (R:US)
IGT U-GAS pilot plant scrubber effluent analysis, 8:11682 (R:US)
UHF RADIATION (01-100 GHZ)
See RADIOWAVE RADIATION
UHF RADIATION (100-1000 MHZ)
See RADIOWAVE RADIATION
UHF RADIATION (LOWER RANGE)
See RADIOWAVE RADIATION
UHF RADIATION (UPPER RANGE)
See RADIOWAVE RADIATION
UJM
See JET MODEL
ULCC
See TANKER SHIPS
ULTRAHIGH FREQUENCY RADIATION (01-100 GHZ
See RADIOWAVE RADIATION
ULTRAHIGH FREQUENCY RADIATION (100-1000 M
See RADIOWAVE RADIATION
ULTRAHIGH FREQUENCY RADIATION (LOWER RANG
See RADIOWAVE RADIATION
ULTRAHIGH FREQUENCY RADIATION (UPPER RANG
See RADIOWAVE RADIATION
ULTRASONIC TESTING
Ultrasonic examination of JBK-75 strip material, 8:13493 (R:US)
Automation
Coincident inspection: FY-82 report, 8:12878 (R:US)
Data Analysis
Flaw characterization with ultrasonic phase and frequency information, 8:12879 (R:US)
Image Processing
Flaw characterization with ultrasonic phase and frequency information, 8:12879 (R:US)
Performance
Study of flow magnitude by means of ultrasonic holography, 8:12877 (R:DE:GE)
ULTRAVIOLET RADIATION
Mutagen Screening
Screening of mutagens by inhibition of DNA synthesis, 8:13191 (BA:US)
Mutagenesis
Comparative action spectra for pyrimidine dimer formation in Cloudman S91 mouse melanoma and EMT6 mouse mammary carcinoma cells, 8:13162 (J:GB)
Effect of mutations in the uthetarD cistron of Escherichia coli on repair resynthesis, 8:13168 (J:NL)
Single-strand breaks induced in Bacillus subtilis DNA by ultraviolet light: action spectrum and properties, 8:13163 (J:GB)
UNCORRELATED-JET MODEL
See JET MODEL
UNDERGROUND DISPOSAL
Flow Models
Solubility equilibria in basalt aquifers: the Columbia Plateau, Eastern Washington, USA, 8:11916 (J:NL)
UNDERGROUND EXPLOSIONS
Data Acquisition Systems
Timing and control monitor system requirements: an overview, 8:13015 (R:US)
Monitoring
Timing and control monitor system requirements: an overview, 8:13015 (R:US)

UNDERGROUND GASIFICATION
See IN-SITU GASIFICATION
UNDERGROUND HEAT DISTRIBUTION SYSTEMS
See HEAT DISTRIBUTION SYSTEMS
UNDERGROUND MINING
See also LONGWALL MINING
Backfilling
Returning coal waste underground. Phase I: report addendum, 8:11732 (R:US)
Hazards
Ground-water problems in open-pit and underground mines, 8:11740 (J:US)
Mining Equipment
Power supplies, 8:11737 (R:US)
Water Influx
Ground-water problems in open-pit and underground mines, 8:11740 (J:US)
UNEMPLOYMENT
See EMPLOYMENT
UNIFIED GAUGE MODELS
Topics in phenomenology of unified gauge theories of weak, electromagnetic, and strong interactions, 8:13289 (R:US)
Symmetry Breaking
Comment on tumbling gauge theories, 8:13291 (J:NL)
UNION OF SOVIET SOCIALIST REPUBLICS
See USSR
UNITED KINGDOM
Nuclear Power Plants
Survey of defects in pressure vessels in the UK for the period 1962-1978 and its relevance to nuclear primary circuits, 8:12354 (R:GB)
UNITED STATES OF AMERICA
See USA
URANIUM
See also URANIUM-ALPHA
URANIUM-GAMMA
Activation Analysis
Determination of uranium and thorium in semiconductor memory materials by high fluence neutron activation analysis, 8:12766 (J:CH)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Adsorption
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)
Fluorescence Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Nondestructive Analysis
Selected measurement data for plutonium and uranium, 8:11940 (R:US)
Precipitation
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Radiation Monitoring
Aerial radiological survey of the Argonne National Laboratory and surrounding area, Argonne, Illinois. Date of survey: May 1977, 8:13064 (R:US)
Radioecological Concentration
Present municipal water treatment and potential removal methods, 8:13086 (RA:US)
Texas Panhandle soil-crop-beef food chain for uranium: a dynamic model validated by experimental data, 8:13065 (R:US)
Radiometric Analysis
Uranium content of petroleum by fission track technique, 8:12761 (R:BR)
Removal
Literature survey, 8:13085 (RA:US)
Methods of removing uranium from drinking water. I. A literature survey. II. Present municipal water treatment and potential removal methods, 8:13084 (R:US)
Present municipal water treatment and potential removal methods, 8:13086 (RA:US)
Solubility
Radionuclide sorption of Columbia River basalt interbed materials, 8:13091 (R:US)
Tissue Distribution
US Uranium Registry tissue program, 8:12828 (BA:US)
URANIUM 233
Energy Levels
Nuclear chemistry project. Progress report, April 1, 1982-March 31, 1983, 8:13349 (R:US)
Muonic Atoms
Nuclear chemistry project. Progress report, April 1, 1982-March 31, 1983, 8:13349 (R:US)
Nuclear Electric Moments
Nuclear chemistry project. Progress report, April 1, 1982-March 31, 1983, 8:13349 (R:US)
URANIUM 235
E3-Transitions
Change of conversion factors of E3-transition in sup(235m)U at population variations of uranium atom shell valent zone orbits, 8:13354 (RA:SU:In Russian)
Fission Ratio
Spectral and dosimetric characteristics of a moderated-neutron calibration facility, 8:13399 (RA:US)
Internal Conversion
Change of conversion factors of E3-transition in sup(235m)U at population variations of uranium atom shell valent zone orbits, 8:13354 (RA:SU:In Russian)
Isotope Separation
Uranium enrichment, 8:12474 (R:US)
Radioecological Concentration
Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R:US)
URANIUM 235 TARGET
Neutron Reactions
Analysis of the average ^{235}U, ^{238}U and ^{239}Pu fission cross sections on ^{235}U and ^{252}Cf fission neutron spectra, 8:13351 (RA:SU:In Russian)
Fission-fragment angular distributions and total kinetic energies for ^{236}U(n,f) from .18 to 8.83 MeV, 8:13348 (R:US)
URANIUM 238
Energy Levels
^{238}U and ^{232}Th levels excited in the (n, n') reactions with 3 MeV neutrons, 8:13352 (RA:SU:In Russian)
Fission Products
Fission of natural uranium in tumor and normal tissue, 8:13173 (TJ:US)
Muonic Atoms
Radiationless excitation of the nucleus in the ^{238}U muonic atoms, 8:13241 (RA:SU:In Russian)
Radioecological Concentration
Radionuclide characterization of subsurface soil on the site of building 3505 at Oak Ridge National Laboratory, 8:13066 (R:US)
URANIUM 238 TARGET
Carbon 12 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Neon 20 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Neutron Reactions
^{238}U and ^{232}Th levels excited in the (n, n') reactions with 3 MeV neutrons, 8:13352 (RA:SU:In Russian)
Analysis of the average ^{235}U, ^{238}U and ^{239}Pu fission cross sections on ^{235}U and ^{252}Cf fission neutron spectra, 8:13351 (RA:SU:In Russian)

Proton Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)

URANIUM BASE ALLOYS
Eutectoids
Revision of the eutectoid isotherms of the uranium-chromium system, 8:12692 (R:US)

URANIUM COMPLEXES
Solubility
Importance of organic compounds in ground water as radionuclide-mobilizing agents, 8:11925 (R:US)

URANIUM DEPOSITS
Aerial Prospecting
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11841 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11839 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11840 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11842 (R:US)
Airborne gamma-ray spectrometer and magnetometer survey: Buckshot, Texas. Final report, detail area, 8:11838 (R:US)
Evaluation
Evaluation of uranium geochemical anomalies in the Charlotte 1° x 2° NTMS quadrangle, 8:11829 (R:US)
Exploration
Hydrochemical and stream sediment detailed geochemical survey for Kettle Falls and Midnite Mine Areas, Washington, 8:11837 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Phoenix quadrangle, Arizona. Uranium Resource Evaluation Project, 8:11830 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Idaho Falls quadrangle, Idaho. Uranium Resource Evaluation Project, 8:11836 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Fresno and Death Valley quadrangles, California; Nevada. Uranium Resource Evaluation Project, 8:11832 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Adel, Jordan Valley, and Twin Falls quadrangles, Oregon; Idaho. Uranium Resource Evaluation Project, 8:11834 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Caliente, Lund, Ely, and Elko Quadrangles, Nevada; Utah, 8:11833 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for San Luis Obispo and Santa Cruz Quadrangles, California, 8:11831 (R:US)
Hydrogeochemical and stream-sediment reconnaissance basic data for Hailey and Challis Quadrangles, Idaho, 8:11835 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)

URANIUM DIOXIDE
Chemical Reaction Kinetics
Partial-equilibrium model based on the kinetics of dissolution and equilibrium in solution of the UO_2-FeS_2-$Fe_2(SO_4)_3$-H_2SO_4 system, 8:12823 (R:US)
Dissolution
Partial-equilibrium model based on the kinetics of dissolution and equilibrium in solution of the UO_2-FeS_2-$Fe_2(SO_4)_3$-H_2SO_4 system, 8:12823 (R:US)
Fabrication
Improved specifications for fast reactor fuel, 8:12370 (R:US)
Foams
Assessment of fuel-foaming potential during core-meltdown accidents, 8:12414 (R:US)
Mechanical Properties
Shock-compression parameters for uranium dioxide from 5 to 330 GPa, 8:11846 (J:NL)
Thermodynamic Properties
Vapor pressures and vapor compositions in equilibrium with hypostoichiometric uranium dioxide at high temperatures, 8:12718 (J:NL)
Vapor Pressure
Vapor pressures and vapor compositions in equilibrium with hypostoichiometric uranium dioxide at high temperatures, 8:12718 (J:NL)

URANIUM HEXAFLUORIDE
Nuclear Materials Management
Loss detection and alarm resolution in processing special nuclear material, 8:11941 (R:US)

URANIUM ISOTOPES
See also URANIUM 233
URANIUM 235
URANIUM 238
Isotope Separation
Multipass batch-step advanced isotope separation campaign models, 8:11845 (J:US)

URANIUM MILLS
See FEED MATERIALS PLANTS

URANIUM MINERALS
Raman Spectra
Physical-chemical studies of transuranium elements. Progress report, April 1, 1982-March 31, 1983, 8:12775 (R:US)

URANIUM MINES
Health Hazards
Ohio River Basin energy study: health aspects, 8:12284 (R:US)

URANIUM OXIDE FUEL PLANT
See MIXED OXIDE FUEL FABRICATION PLANTS

URANIUM OXIDES U3O8
Chemical Properties
Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982, 8:11928 (R:US)
Dissolution
Use of in vitro dissolution data when interpreting uranium bioassay data, 8:11930 (RA:US)
Lung Clearance
Comparison of infrared analysis and in vitro dissolution results with clearance of inhaled uranium in rats exposed to yellowcake aerosols, 8:13154 (RA:US)
Radionuclide Kinetics
Biological characterization of radiation exposure and dose estimates for inhaled uranium milling effluents. Annual progress report, April 1981-March 1982, 8:11928 (R:US)
Retention
Comparison of infrared analysis and in vitro dissolution results with clearance of inhaled uranium in rats exposed to yellowcake aerosols, 8:13154 (RA:US)
Retention and translocation of uranium following subcutaneous implantation in rats of yellowcake powder from two uranium mills, 8:13153 (RA:US)
Solubility
Measurements to determine the solubility of uranium yellowcake materials in the lungs of millworkers following acute exposure, 8:13156 (R:US)
Use of in vitro dissolution data when interpreting uranium bioassay data, 8:11930 (RA:US)
Translocation
Retention and translocation of uranium following subcutaneous implantation in rats of yellowcake powder from two uranium mills, 8:13153 (RA:US)

URANIUM-ALPHA
Transition Temperature
Causes for the variable superconducting transition temperature in uranium metal, 8:12696 (J:GB)

URANIUM-GAMMA
Diffusion
Chemical diffusion of Ta in γ-U in samples fabricated for positron studies, 8:12694 (J:NL)

URBAN AREAS
Planning
Effects of urban development patterns on transportation energy use, 8:12583 (RA:US)

Transportation Systems
Costs and benefits of energy consumption by public transit, 8:12600 (RA:US)
Effects of urban development patterns on transportation energy use, 8:12583 (RA:US)
Energy efficiency: which modes, which programs, 8:12596 (RA:US)
URINALYSIS
See URINE
URINE
Chemical Analysis
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Mutagen Screening
Exposure of pharmacy personnel to mutagenic antineoplastic drugs, 8:13130 (R:US)
US DOE
See also AMES LABORATORY
ANL
BATTELLE PACIFIC NORTHWEST LABORATORIES
BNL
BONNEVILLE POWER ADMINISTRATION
HANFORD RESERVATION
IDAHO NATIONAL ENGINEERING LABORATORY
LASL
LAWRENCE LIVERMORE LABORATORY
NEVADA TEST SITE
ORGDP
ORNL
PANTEX PLANT
SAVANNAH RIVER PLANT
STANFORD LINEAR ACCELERATOR CENTER
Advisory Committees
Guiding R and D policy, 8:12473 (J:US)
Contracts
Types of Contracts and Agreements Guide (Part II): cost-plus-award-fee contracting, 8:13534 (R:US)
Energy Policy
United States Department of Energy: a history, 8:12487 (R:US)
Environmental Policy
Approach to E, S, and H assurance programs for institutions. Volume II. Line-organization functions, 8:12469 (R:US)
Manuals
Types of Contracts and Agreements Guide (Part II): cost-plus-award-fee contracting, 8:13534 (R:US)
Nuclear Facilities
Accident analysis and DOE criteria, 8:11927 (R:US)
Reactor Safety
DOE plans for LWR safety research, 8:12422 (J:US)
Regulations
Industrial coal utilization: fourth annual symposium, 8:11780 (R:US)
Research Programs
Guiding R and D policy, 8:12473 (J:US)
US DOI
See also US GS
Interagency Cooperation
Streamlining internal administrative procedures for geothermal development at the US Geological Survey, US Bureau of Land Management and the US Forest Service, 8:12219 (RA:US)
Organizational Models
Interior's minerals-management programs need consolidation to improve accountability and control, 8:12488 (R:US)
US EPA
Regulations
Industrial coal utilization: fourth annual symposium, 8:11780 (R:US)
US FOREST SERVICE
Interagency Cooperation
Streamlining internal administrative procedures for geothermal development at the US Geological Survey, US Bureau of Land Management and the US Forest Service, 8:12219 (RA:US)
US GEOLOGICAL SURVEY
See US GS
US GS
Interagency Cooperation
Streamlining internal administrative procedures for geothermal development at the US Geological Survey, US Bureau of Land Management and the US Forest Service, 8:12219 (RA:US)
US NRC
United States Nuclear Regulatory Commission-prior to 1975 was part of US AEC.
Document Types
Title list of documents made publicly available, August 1-31, 1982, 8:12328 (R:US)
Legal Aspects
Nuclear Regulatory Commission Issuances, 8:12329 (R:US)
Nuclear Facilities
Summary information report, 8:12330 (R:US)
Reactor Safety
ACRS review of the 1983 NRC Safety Research Program, 8:12421 (J:US)
Standardized Terminology
Impact of source term assumptions on reactor accident consequences, 8:12430 (J:US)
USA
See also FEDERAL REGION X
GREAT BASIN
WASHINGTON DC
BWR Type Reactors
Events resulting in reactor shutdown and their causes, 8:12426 (J:US)
Climates
January 1980 environmental data for sites in the National Solar Data Network, 8:12013 (R:US)
Coal Deposits
RD and D initiatives for low-rank coals: follow-up to the low-rank coal study (USA; low rank), 8:11582 (RA:US)
Study of the United States coal resources (Appalachian Plateau, Interior Basins, Gulf Coastal Plain, Rocky Mountain Basins, High Plains, North Alaska), 8:11717 (R:US)
Coal Reserves
Advanced Coal-Extraction-Systems Project: report of activities for fiscal year 1980-1981 (By coal field and basin), 8:11716 (R:US)
Coal supply factor is it largely romance or a solid plus, 8:11773 (RA:US)
RD and D initiatives for low-rank coals: follow-up to the low-rank coal study (USA; low rank), 8:11582 (RA:US)
Study of the United States coal resources (Appalachian Plateau, Interior Basins, Gulf Coastal Plain, Rocky Mountain Basins, High Plains, North Alaska), 8:11717 (R:US)
Energy Conservation
Options for electricity use and management during a petroleum shortage, 8:12508 (R:US)
Energy Consumption
Alternatives of the industrial energy planner, 8:12616 (RA:US)
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Energy Demand
Outlook for synthetic fuels (Forecasting), 8:12496 (RA:US)
Potential for commercial synthetic fuels in the US energy future (Forecasting), 8:12492 (RA:US)
Energy Policy
Synthetic fuels from coal: our moral equivalent of war, 8:11775 (RA:US)
Energy Supplies
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Outlook for synthetic fuels (Forecasting), 8:12496 (RA:US)
Potential for commercial synthetic fuels in the US energy future (Forecasting), 8:12492 (RA:US)
Synthetic fuels: past performance and future plans, 8:12493 (RA:US)
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Geothermal Exploration
Geothermal resource exploration, 8:12216 (J:US)
Harbors
Future coal export demand and its effect on the United States market (USA), 8:11746 (RA:US)
Nuclear Power Plants
Licensee event report (LER) compilation for the month of November 1982, 8:12410 (R:US)

Operating US power reactors, 8:12297 (J:US)
Status of power-reactor projects undergoing licensing review, 8:12332 (J:US)
Unresolved safety issues summary: aqua book, 8:12405 (R:US)
UPDATE: nuclear-power-program information and data, July-September 1982, 8:12335 (R:US)
Peat
Overview of state peat resource programs, 8:11701 (RA:US)
Peat conversion and utilization in the United States, 8:11719 (RA:US)
Power Generation
Methodology and results of the impacts of modeling electric utilities: a comparative evaluation of MEMM and REM, 8:12507 (R:US)
PWR Type Reactors
Events resulting in reactor shutdown and their causes, 8:12426 (J:US)
Reactor Licensing
Reactor licensing in the United States and Federal Republic of Germany, 8:12323 (R:BR:In Portuguese)
Research Reactors
Events resulting in reactor shutdown and their causes, 8:12426 (J:US)
Synthetic Fuels Industry
Shape and pace of the United Staes synthetic fuels industry, 8:11779 (RA:US)

USSR
Peat
Comprehensive use of peat in the USSR, 8:11727 (RA:US)

UTAH
Geochemical Surveys
Hydrogeochemical and stream-sediment reconnaissance basic data for Caliente, Lund, Ely, and Elko Quadrangles, Nevada; Utah, 8:11833 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Natural Gas Deposits
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R:US)
Petroleum Deposits
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R:US)
Uranium Deposits
Hydrogeochemical and stream-sediment reconnaissance basic data for Caliente, Lund, Ely, and Elko Quadrangles, Nevada; Utah, 8:11833 (R:US)

UTERINE CERVIX CARCINOMA
See CARCINOMAS

UTILITIES
See ELECTRIC UTILITIES
GAS UTILITIES

V

VACUUM SYSTEMS
Changing MFTF vacuum environment, 8:13498 (R:US)

VAK REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)

VALENCE ELECTRONS
See ELECTRONS

VALUES
Electroslag Casting
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)

VANADIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Sputtering
Physical sputtering of candidate plasma-side materials for FED/INTOR, 8:13494 (R:US)

VANADIUM ALLOYS
See also VANADIUM BASE ALLOYS
Atom Transport
Hydrogen and deuterium diffusion in vanadium alloys (Containing Ti or Nb), 8:12676 (R:US)

VANADIUM BASE ALLOYS
Physical Radiation Effects
Formation of helium-gas bubbles in the vanadium-titanium binary and ternary alloys irradiated by energetic Ni^{++} ions (Preimplanted with helium ions), 8:12674 (R:US)

VANADIUM HYDRIDES
Crystal-Phase Transformations
Structure and phase transitions in the vanadium-hydrogen and vanadium-deuterium system, 8:11957 (R:DE:In German)
Nuclear Magnetic Resonance
NMR study of phase transitions in VT/sub 0.50/ and VT/sub 0.75/, 8:12719 (J:US)
Phase Studies
Activity of hydrogen in metal-hydrogen systems: strontium, thorium-nitrogen, and vanadium alloys, 8:12712 (R:US)
Phase Transformations
NMR study of phase transitions in VT/sub 0.50/ and VT/sub 0.75/, 8:12719 (J:US)

VANADIUM MINERALS
See MINERALS

VANADIUM NITRIDES
Electronic Structure
Electron-energy-loss and ultraviolet-photoemission study of VN/sub x/, NbN/sub x/, and ZrN/sub x/, 8:12711 (R:US)

VANPOOLING
Economics
Carpools and vanpools - potential for major energy savings, 8:12597 (RA:US)
Institutional Factors
Carpools and vanpools - potential for major energy savings, 8:12597 (RA:US)

VAPORIZATION
See EVAPORATION

VAPORS
See also WATER VAPOR
Flow Models
Destabilization of Leidenfrost boiling by a sudden rise of ambient pressure, 8:12345 (J:GB)

VARIABLE ENERGY CYCLOTRONS
Superconducting Magnets
Deuteron cyclotron complex on the base of superconducting sector magnets, 8:12895 (R:SU:In Russian)

VAX COMPUTERS
See DEC COMPUTERS

VEGETATION
See PLANTS

VEHICLES
See also AUTOMOBILES
BICYCLES
BUSES
ELECTRIC-POWERED VEHICLES
FLYWHEEL-POWERED VEHICLES
SPACE VEHICLES
TRAINS
TRUCKS
Fuel Substitution
Alternative fuels - where we are today and where we need to go: status of technology, issues, requirements for R and D, 8:12586 (RA:US)

VENEZIANO MODEL
Baryons
Topological expansion for baryons and mesons, 8:13281 (J:IT)
Mesons
Topological expansion for baryons and mesons, 8:13281 (J:IT)

VENTILATION DUCTS
See DUCTS
VERMONT
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
VERSUCHSATOMKRAFTWERK KAHL REACTOR
See VAK REACTOR
VERY HIGH FREQUENCY RADIATION
See RADIOWAVE RADIATION
VESSELS
See CONTAINERS
VESSELS (CHEMICAL REACTIONS)
See CHEMICAL REACTORS
VESSELS (PRESSURE)
See PRESSURE VESSELS
VHF RADIATION
See RADIOWAVE RADIATION
VIBRATIONS (MECHANICAL)
See MECHANICAL VIBRATIONS
VINYL CYANIDE
See ACRYLONITRILE
VIRGINIA
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
VISCOSIMETERS
Design
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
VISIBLE RADIATION
Absorption
Charge separation in the light reactions of photosynthesis, 8:13128 (BA:US)
Electron Transfer
Charge separation in the light reactions of photosynthesis, 8:13128 (BA:US)
VISITOR CENTERS
See PUBLIC BUILDINGS
VITAMIN B-12
Chemical Preparation
Kinetic studies of organocobalt compounds related to vitamin B_{12} coenzymes (B12s), 8:12786 (R:US)
Electrochemistry
Kinetic studies of organocobalt compounds related to vitamin B_{12} coenzymes (B12s), 8:12786 (R:US)
VITAMIN C
See ASCORBIC ACID
VITRINITE
See MACERALS
VLCC
See TANKER SHIPS
VOLATILIZATION
See EVAPORATION
VOLCANIC REGIONS
Age Estimation
Geochronology and evolution of the Clear Lake Volcanics, 8:12190 (RA:US)
Paleomagnetism of the Clear Lake Volcanics and new limits on the age of the Jaramillo normal-polarity event, 8:12192 (RA:US)
Geologic History
Geochronology and evolution of the Clear Lake Volcanics, 8:12190 (RA:US)
Paleomagnetism
Paleomagnetism of the Clear Lake Volcanics and new limits on the age of the Jaramillo normal-polarity event, 8:12192 (RA:US)
VOLCANIC ROCKS
See also BASALT
Petrogenesis
Preliminary investigation of accessory zircons from volcanic and sedimentary rocks from Clear Lake, 8:12253 (RA:US)
VOLTAIC CELLS
See ELECTRIC BATTERIES
VORTEX FLOW
Two-Dimensional Calculations
Green's functions at zero viscosity, 8:13247 (R:US)

W

WASHERS, CLOTHES
See CLOTHES WASHERS
WASHINGTON
See also MT ST HELENS
Geochemical Surveys
Hydrochemical and stream sediment detailed geochemical survey for Kettle Falls and Midnite Mine Areas, Washington, 8:11837 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Uranium Deposits
Hydrochemical and stream sediment detailed geochemical survey for Kettle Falls and Midnite Mine Areas, Washington, 8:11837 (R:US)
WASHINGTON DC
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
WASTE BURIAL
See UNDERGROUND DISPOSAL
WASTE DISPOSAL
See also RADIOACTIVE WASTE DISPOSAL
SANITARY LANDFILLS
UNDERGROUND DISPOSAL
Computerized Simulation
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Environmental Effects
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Legislation
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Permit Applications
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Recommendations
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Regulations
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
Technology Assessment
Field-simulation analysis for disposal of liquefaction solid waste. Final report, 8:11640 (R:US)
WASTE PROCESSING PLANTS
See also RESOURCE RECOVERY FACILITIES
Fuel cell cogeneration in the wastewater treatment industry, 8:12543 (BA:US)
Aerosol Monitoring
New analytical techniques for mycotoxins in complex organic matrices, 8:12757 (R:US)
WASTE PRODUCT UTILIZATION
Life-Cycle Cost
Levelized life-cycle costs for four residue-collection systems and four gas-production systems, 8:12063 (R:US)
WASTE SOLUTIONS
See LIQUID WASTES

WASTE TRANSPORTATION
Accidents
Analysis and model testing of a Super Tiger Type B Waste transport system in accident environments, 8:12863 (J:US)
Alpha-Bearing Wastes
Structural analysis of the TRUPACT contact-handled Transuranic waste transporter, 8:11861 (J:US)
Containers
Structural analysis of the TRUPACT contact-handled Transuranic waste transporter, 8:11861 (J:US)
Life-Cycle Cost
Levelized life-cycle costs for four residue-collection systems and four gas-production systems, 8:12063 (R:US)
WASTE WATER
Anaerobic Digestion
Anaerobic treatment of gasifier effluents. Quarterly report No. 5, 8:11684 (R:US)
Chemical Composition
IGT U-GAS pilot plant scrubber effluent analysis (Very detailed analytical results), 8:11682 (R:US)
Filtration
Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)
Osmosis
Coal-conversion support studies. Project 61046 quarterly report, May 19-August 18, 1981, 8:11625 (R:US)
Ozonization
Application of ozone to eliminate tertiary treatment of wastewater used for industrial cooling. Final technical report, 8:12624 (R:US)
Waste Processing
Application of ozone to eliminate tertiary treatment of wastewater used for industrial cooling. Final technical report, 8:12624 (R:US)
Water Treatment
Fossil-energy program. Quarterly progress report for the period ending September 30, 1982, 8:11583 (R:US)
Shell coal gasification process, 8:11585 (RA:US)
WASTE-FUELED BOILERS
See REFUSE-FUELED BOILERS
WASTE-FUELED POWER PLANTS
See REFUSE-FUELED POWER PLANTS
WASTES
See also GASEOUS WASTES
LIQUID WASTES
MUNICIPAL WASTES
RADIOACTIVE WASTES
SEWAGE
SOLID WASTES
Gasification
Fuel-cell power-system configurations utilizing waste-derived fuels. Summary of final technical report for the period September 1977-August 1978, 8:12525 (R:US)
WATER
See also DRINKING WATER
GROUND WATER
SEAWATER
WASTE WATER
Chemical Analysis
Atmospheric-pressure nitrogen (APAN): a new source for analytical emission spectroscopy, 8:12754 (R:US)
Chemical Reactions
Use of supercritical water for extraction of low rank coals, 8:11634 (RA:US)
Coalescence
Magnitude and role of dynamic interfacial effects in low tension flooding, 8:11806 (J:US)
Compatibility
Fusion-reactor blanket-material safety-compatibility studies, 8:13483 (R:US)
Emulsification
Oil banking phenomena in surfactant/polymer and caustic flooding: droplet coalescence and entrapment processes, 8:11805 (J:US)
Photon Transport
Attenuation of photon beams from radionuclides. Pt. 6, 8:13373 (R:DE:In German)
Purification
Literature survey, 8:13085 (RA:US)
Sorption
Micro-macropore model for sorption of water on silica gel in a dehumidifier, 8:12175 (J:GB)
WATER CONTENT
See HUMIDITY
WATER COOLANT
See WATER
WATER COOLED REACTORS
See also BWR TYPE REACTORS
PWR TYPE REACTORS
Engineering Physics Division progress report period ending May 31, 1982, 8:12342 (R:US)
Blowdown
Phase separation. Final report, 8:12383 (R:DE:GE)
Fuel Cans
SEM-TEM Sampling technique for use with fuel LWR cladding, 8:12432 (J:US)
Fuel Rods
Fuel-rod vibration with reduced spacer spring preload, 8:12293 (R:US)
Hydrodynamics
TRAC-PD2 Calculations of CREARE countercurrent flow tests, 8:12298 (J:US)
WATER DISTRIBUTION
See WATER SUPPLY
WATER HEATERS
See also SOLAR WATER HEATERS
Field Tests
Evaluating water heating alternatives, 8:12140 (RA:US)
Heat Pumps
Evaluating water heating alternatives, 8:12140 (RA:US)
Heat Recovery
Evaluating water heating alternatives, 8:12140 (RA:US)
Off-peak Power
Evaluating water heating alternatives, 8:12140 (RA:US)
WATER MODERATOR
See WATER
WATER PUMPS
Wind Turbines
Wind-assist irrigation and electrical-power generation. Final report, 8:12266 (R:US)
WATER RESOURCES
Energy resources in California, 8:12483 (R:US)
WATER SOLUTIONS
See AQUEOUS SOLUTIONS
WATER SOURCE HEAT PUMPS
Coefficient of Performance
Non-residential groundwater-heat-pump retrofit demonstration. Final report, 8:12578 (R:US)
Computerized Simulation
Groundwater-source heat-pump design development: consideration of locally variable factors. Final report, 8:12580 (R:US)
Performance
Groundwater-source heat-pump design development: consideration of locally variable factors. Final report, 8:12580 (R:US)
WATER SUPPLY
Used in the sense of a public utility or of an engineered system (e.g., irrigation system) as contrasted to a natural system, for which use WATER RESOURCES.
Management
Unique features and operating experiences of the 1500-MW Laramie River Station utilizing Powder River Basin subbituminous coal, 8:12274 (RA:US)
Water Treatment
Unique features and operating experiences of the 1500-MW Laramie River Station utilizing Powder River Basin subbituminous coal, 8:12274 (RA:US)
WATER VAPOR
Adsorption
Adsorption of ethanol and water vapor by Silicalite, a hydrophobic molecular sieve, 8:12061 (R:US)
WATERBORNE PARTICLES
See PARTICULATES

WATERFLOODING
Multiphase Flow
Interfacial effects upon displacement in sinusoidal capillaries, 8:11803 (J:US)
WATERSHEDS
Site Surveys
Ecological characterization of the central and northern California coastal region. Volume IV. Watersheds and basins. Chapters 1-16, 8:13070 (R:US)
Ecological characterization of the central and northern Californa coastal region. Volume IV. Watersheds and basins. Chapters 17-29, 8:13071 (R:US)
WATERWALL FURNACES
See WATERWALL INCINERATORS
WATERWALL INCINERATORS
Cogeneration
Thermal-economic analysis of cogenerated energy recovery by mass-burning modular refuse incinerators. IIT Energy Management Report TR-82-2, 8:12639 (R:US)
Economic Analysis
Thermal-economic analysis of cogenerated energy recovery by mass-burning modular refuse incinerators. IIT Energy Management Report TR-82-2, 8:12639 (R:US)
Thermal Analysis
Thermal-economic analysis of cogenerated energy recovery by mass-burning modular refuse incinerators. IIT Energy Management Report TR-82-2, 8:12639 (R:US)
WAVE ENERGY CONVERTERS
Ocean thermal energy at the Johns Hopkins University Applied Physics Laboratory, quarterly report. Report for Jan-Mar 82, 8:12133 (R:US)
WAZ 16
See NICKEL BASE ALLOYS
WEAK PARTICLE DECAY
Report on results about weak and electroweak decays of hadrons and related phenomenological Lagrangians. Progress report, 8:13273 (R:US)
WEAPONS
See also NUCLEAR WEAPONS
Test Facilities
Tonopah Test Range capabilities: technical manual, 8:13014 (R:US)
WEATHER
Using weather forecasts for a more efficient use of heating systems, 8:12554 (RA:CH)
Economic Impact
Effects of atmospheric variability on energy utilization and conservation, 8:12555 (RA:CH)
WECS
See WIND TURBINES
WELDED JOINTS
Ultrasonic Testing
Coincident inspection: FY-82 report, 8:12878 (R:US)
WELDING
See also ELECTRON BEAM WELDING
Energy Conservation
Coincident inspection: FY-82 report, 8:12878 (R:US)
Quality Assurance
Coincident inspection: FY-82 report, 8:12878 (R:US)
WELDING MACHINES
Design
Operations manual: fiber-optics welder, 8:12846 (R:US)
Maintenance
Operations manual: fiber-optics welder, 8:12846 (R:US)
Repair
Operations manual: fiber-optics welder, 8:12846 (R:US)
WELDS
See WELDED JOINTS
WELL DRILLING
Research Programs
Geothermal technology development program. Annual progress report, October 1980-September 1981, 8:12247 (R:US)
WELL LOGGING EQUIPMENT
To be used only when the equipment itself is the topic of the paper; includes source, detector, and associated equipment.
Inertial Guidance
Wellborne inertial navigation system, 8:13213 (R:US)
WELLS
See also GEOTHERMAL WELLS
NATURAL GAS WELLS
OIL WELLS
Testing
Instrumentation for well tests, 8:12251 (J:US)
WEST GERMANY
See FEDERAL REPUBLIC OF GERMANY
WEST VIRGINIA
Geology
Regional geological assessment of the Devonian-Mississippian shale sequence of the Appalachian, Illinois, and Michigan basins relative to potential storage/disposal of radioactive wastes, 8:11898 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Transport Regulations
Transportation of radioactive materials. Volume IV. Executive summaries, 8:11850 (R:US)
WESTERN US OVERTHRUST BELT
Geology
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R:US)
WESTINGHOUSE GASIFICATION PROCESS
Fuel Gas
Gas characterization from fluidized-bed coal gasification. Fourth quarterly report, June 1-August 31, 1982, 8:11627 (R:US)
WET-TYPE COOLING TOWERS
See COOLING TOWERS
WIND
Data Compilation
January 1980 environmental data for sites in the National Solar Data Network, 8:12013 (R:US)
Monitoring
Wind measurements for large wind turbines, 8:12258 (RA:CH)
Nocturnal Variations
Simple nocturnal slope-flow data from the Rattlesnake Mountain site, 8:13023 (R:US)
Research Programs
Swedish meteorologial programme related to solar and wind energy, 8:12009 (RA:CH)
Statistics
Climatic parameters for wind and solar power engineering, 8:12011 (RA:CH)
Principles of a probabilistic/statistical approach to the estimation of potential wind energy and solar radiation, 8:12000 (RA:CH)
Velocity
An assessment of wind characteristics and wind energy conversion systems for electric utilities, 8:12259 (R:US)
Diurnal variability of wind velocity increase with height, 8:13022 (R:US)
WIND ENERGY CONVERSION SYSTEMS
See WIND TURBINES
WIND GENERATORS
See ELECTRIC GENERATORS
WIND TURBINES
WIND POWER
Availability
Wind power potential in Israel and the eastern Mediterranean, 8:12257 (RA:CH)
Research Programs
Texas Energy Development Fund. Project status reports, 8:11998 (R:US)
Resource Assessment
World-wide wind energy resource assessment, 8:12256 (RA:CH)
WIND POWER PLANTS
Equipment Interfaces
Commercial wind-energy-conversion systems (WECS) monitoring and utility-impacts study. Final report, 8:12264 (R:US)

WIND TURBINES
Construction
Use of wind power to assist in stripper (oil) well pumping, 8:12265 (R:US)
Design
Wind-assist irrigation and electrical-power generation. Final report, 8:12266 (R:US)
Economic Analysis
Commercial wind-energy-conversion systems (WECS) monitoring and utility-impacts study. Final report, 8:12264 (R:US)
Electric Generators
Doubly fed machine review: agenda. Conference report, Washington, DC, 8:12263 (R:US)
Hybrid Systems
Technological aspects of the mixed use of solar and wind energy, 8:12108 (RA:CH)
Mathematical Models
Predictions of low-frequency sound from the MOD-1 wind turbine, 8:12260 (R:US)
Noise Pollution
Predictions of low-frequency sound from the MOD-1 wind turbine, 8:12260 (R:US)
Performance
Technological aspects of wind energy conversion, 8:12262 (RA:CH)
Wind-assist irrigation and electrical-power generation. Final report, 8:12266 (R:US)
Performance Testing
Commercial wind-energy-conversion systems (WECS) monitoring and utility-impacts study. Final report, 8:12264 (R:US)
Operating and maintenance experience with a 6-kW wind energy conversion system at Naval Station, Treasure Island, California. Technical note Sep 79-Jun 81, 8:12261 (R:US)
Site Selection
Wind measurements for large wind turbines, 8:12258 (RA:CH)
Technology Assessment
Technological aspects of wind energy conversion, 8:12262 (RA:CH)
WINDFALL PROFITS TAX
Economic Impact
Incidence and effects of a windfall profit tax on natural gas, 8:11819 (R:US)
WINKLER PROCESS
Fuel oil substitution by enriched medium Btu gas produced from coal in Winkler fluidized gasifiers (Including partially methanated synthesis gas), 8:11590 (RA:US)
Economic Analysis
Coal-gasification basic research and costs studies. Quarterly report No. 4, 8:11620 (R:US)
WIRES
X-Ray Radiography
Evaluation of a computer aided X-ray fluorographic system: part 1 - system analysis, 8:12876 (R:GB)
WISCONSIN
Acid Rain
Acid rain: a background report, 8:13029 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Peat
Peat resource assessment in Wisconsin, 8:11715 (RA:US)
WNP-2 REACTOR
Washington Public Power Supply System Nuclear Project Number 2, previously known as Hanford-2 Reactor.
Containment Shells
Buckling of steel containment shells. Task 1b. Buckling of Washington Public Power Supply Systems' plant No. 2 containment vessel. Final report, 25 August 1980-30 September 1982, 8:12296 (R:US)
Electrical Equipment
Safety evaluation report related to the operation of WPPSS Nuclear Project No. 2, Docket No. 50-397, Washington Public Power Supply System, 8:12331 (R:US)
Engineered Safety Systems
Safety evaluation report related to the operation of WPPSS Nuclear Project No. 2, Docket No. 50-397, Washington Public Power Supply System, 8:12331 (R:US)
Reactor Licensing
Safety evaluation report related to the operation of WPPSS Nuclear Project No. 2, Docket No. 50-397, Washington Public Power Supply System, 8:12331 (R:US)
Reactor Safety
Safety evaluation report related to the operation of WPPSS Nuclear Project No. 2, Docket No. 50-397, Washington Public Power Supply System, 8:12331 (R:US)
WOLFRAM
See TUNGSTEN
WOOD
Availability
Feasibility study of the production and use of wood-derived fuels in a large chemical plant. Final report, 8:12052 (R:US)
Combustion
Wood combustion: state-of-knowledge survey of environmental, health and safety aspects, 8:13026 (R:US)
Gasification
Comparison of coal and wood as feedstocks for methanol manufacture, 8:11658 (RA:US)
Feasibility study of the production and use of wood-derived fuels in a large chemical plant. Final report, 8:12052 (R:US)
Investigation of gasification of biomass in the presence of catalysts, 8:12067 (R:US)
Large wood to methanol plants, 8:11987 (RA:US)
Methanol from wood and peat, 8:11989 (RA:US)
Oxygen-blown entrained-flow gasification of wood, 8:11966 (RA:US)
Pressurized fluidized bed gasifier in the synthesis of methanol from wood, 8:11988 (RA:US)
Pressurized oxygen blown fluidized bed gasification of wood, 8:11967 (RA:US)
System design for wood gasification using internal heating, 8:12073 (RA:US)
Meetings
Chemical education and chemical literature. Problems of chimization of agriculture. Problems of wood chemistry. V. 6, 8:11981 (R:SU:RU)
Oil Yields
Entrained flow pyrolysis of biomass, 8:12075 (RA:US)
Production
Low-rank coal exploitation and utilization in east European countries (USSR; 1950 to 1979), 8:11734 (RA:US)
Pyrolysis
Entrained flow pyrolysis of biomass, 8:12075 (RA:US)
Feasibility study of the production and use of wood-derived fuels in a large chemical plant. Final report, 8:12052 (R:US)
Flash pyrolysis of biomass with reactive and non-reactive gases, 8:12078 (RA:US)
WOOD ALCOHOL
See METHANOL
WOOD FUELS
Use of this term is limited to polcy, feasibility, and socio-economic studies. For wood properties use WOOD.
Combustion
Development of wood as an alternative fuel for gas turbine systems, 8:12079 (RA:US)
Procurement
Technology of wood supply, 8:11992 (RA:US)
WOOD WASTES
Cocombustion
Co-utilization of municipal solid waste and wood residues for small-scale resource recovery: a preliminary assessment, 8:12637 (R:US)
Gasification
Application of SGFM technology to alternate feedstocks: Phase III, 8:12069 (RA:US)
Feasibility study for alternative-fuels production: fluidized-bed gasification of wood waste. Biomass Alternative-Fuels Program: final report, 8:12051 (R:US)
Gasification of forest residues in a high-throughput gasifier, 8:12071 (RA:US)

Pyrolysis
Gas turbine demonstration of pyrolysis-derived fuels, 8:12080 (RA:US)
Waste Transportation
Levelized life-cycle costs for four residue-collection systems and four gas-production systems, 8:12063 (R:US)
WORCESTER POLYTECHNIC INSTITUTE POOL REAC
See WPIR REACTOR
WORKERS
See PERSONNEL
WORKING FLUIDS
See also REFRIGERANTS
Comparative Evaluations
Development and demonstration of an electric heat pump for waste-heat recovery in industry. The selection of working-fluid candidates for use in high-temperature industrial heat pumps. Topical report, September 1977-December 1978, 8:12620 (R:US)
WORKING (MATERIALS)
See MATERIALS WORKING
WPIR REACTOR
Reactor Licensing
Safety evaluation report related to the renewal of the operating license for the Worcester Polytechnic Institute open-pool training reactor, Docket No. 50-134, 8:12408 (R:US)
Reactor Safety
Safety evaluation report related to the renewal of the operating license for the Worcester Polytechnic Institute open-pool training reactor, Docket No. 50-134, 8:12408 (R:US)
WUERGASSEN REACTOR
Reactor Accidents
Incidents in German nuclear power stations, 8:12447 (TG:GB)
WYOMING
Geological Surveys
Bibliography and index of Wyoming uranium through 1973. Bulletin 61, 8:11826 (R:US)
Low-Level Radioactive Wastes
1981 state-by-state assessment of low-level radioactive wastes shipped to commercial disposal sites, 8:11851 (R:US)
Natural Gas Deposits
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R:US)
Natural Gas Industry
Wyoming's oil and gas industry. Public information circular No. 17, 8:11788 (R:US)
Oil Fields
North Tisdale Mine: gravity drainage project, 8:11795 (RA:US)
Petroleum Deposits
Search for oil and gas in the Idaho-Wyoming-Utah salient of the overthrust belt. Report of investigations No. 21, 8:11791 (R:US)
Petroleum Industry
Wyoming's oil and gas industry. Public information circular No. 17, 8:11788 (R:US)
Uranium Deposits
Bibliography and index of Wyoming uranium through 1973. Bulletin 61, 8:11826 (R:US)

X

X RADIATION
Mutagen Screening
Screening of mutagens by inhibition of DNA synthesis, 8:13191 (BA:US)
XENON
Ion Spectroscopy
Personnel neutron dosimeters based on organic polymers, 8:12979 (RA:US)
XENON EFFECT
See XENON OSCILLATIONS
XENON OSCILLATIONS
Computer Codes
Nonlinear diffusion theory model for xenon-induced flux oscillations, 8:12346 (D:US)
Multigroup Theory
Nonlinear diffusion theory model for xenon-induced flux oscillations, 8:12346 (D:US)
X-RASERS
See X-RAY LASERS
X-RAY DIFFRACTION
Debye-Scherrer Method
X-ray powder diffraction system for chemical specification of particulate aerosol samples, 8:12764 (J:NL)
X-RAY DIFFRACTOMETERS
High-resolution x-ray scattering, 8:12913 (R:US)
X-RAY LASERS
Design
Resonantly-pumped soft-x-ray lasers using ICF drivers, 8:13497 (R:US)
X-RAY RADIOGRAPHY
Equipment
Evaluation of a computer aided X-ray fluorographic system: part 1 - system analysis, 8:12876 (R:GB)
X-RAY SPECTRA
Data Acquisition Systems
ND6600 computer in fusion-energy research, 8:13445 (R:US)
X-RAY SPECTROMETERS
Design
Design philosophy for high-resolution rate and throughput spectroscopy systems, 8:13443 (R:US)
XYLOSE
Fermentation
Fermentation to ethanol of xylose present in biomass byproduct solution. Progress report, April 1-December 31, 1982, 8:12042 (R:US)
Some aspects of thermophilic and extreme thermophilic anaerobic microorganisms, 8:13135 (BA:US)

Y

YELLOW CAKE
See URANIUM OXIDES U3O8
YTTERBIUM
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
YTTERBIUM 169
Electron Capture Decay
Auger KMM transitions of thulium arising in $_{70}169$Yb decay, 8:13239 (RA:SU:In Russian)
YTTERBIUM BROMIDES
Crystal Structure
Investigations on the structure and polymorphy of the dibromides of dysprosium, thulium, ytterbium and calcium, 8:12781 (R:DE:In German)
YTTERBIUM HYDRIDES
Crystal Structure
Structural transformation of YbH_3 induced by high pressure, 8:12778 (RA:DK)
Structures of ytterbium-dihydride, 8:12779 (RA:DK:In Danish)
YTTERBIUM ISOTOPES
See also YTTERBIUM 169
E2-Transitions
Nonadiabatic deviation of E2-transition probabilities in Yb isotopes, 8:13339 (RA:SU:In Russian)
YTTRIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)

Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)
Permeability
Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium, 8:13495 (R:US)
Sorptive Properties
Diffusivity of hydrogen isotopes in liquid lithium and in solid yttrium, 8:13495 (R:US)

YTTRIUM 89 TARGET
Carbon 12 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Neon 20 Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)
Proton Reactions
Coulomb dissociation in relativistic heavy-ion reactions, 8:13312 (R:US)

YTTRIUM ALUMINIUM GARNETS
See ALUMINIUM OXIDES
FERRITE GARNETS
YTTRIUM COMPOUNDS

YTTRIUM BORIDES
Magnetic Properties
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)
Superconductivity
Superconductivity and long-range magnetic order in ternary rare-earth transition-metal borides, 8:12714 (R:US)

YTTRIUM COMPOUNDS
See also YTTRIUM BORIDES
Phase Transformations
Moessbauer studies of orientational transitions in substituted ferrite garnets, 8:12782 (RA:SU:In Russian)

Z

ZEA MAYS
See MAIZE

ZEOLITES
See also MORDENITE
Catalytic Effects
Investigation of sulfur-tolerant catalysts for selective synthesis of hydrocarbon liquids from coal-derived gases. Annual technical progress report, September 19, 1981-September 18, 1982, 8:11960 (R:US)
Sorptive Properties
H_2 and CO chemisorption on metal-carbonyl-extracted coal-liquefaction catalysts. Final report, 8:11646 (R:US)

ZET PINCH
See LONGITUDINAL PINCH

ZFK ROSSENDORF
Research Programs
Central Institute of Nuclear Research Rossendorf 25 years old, 8:12472 (R:DD:In German)

ZINC
Catalytic Effects
Method for the preparation of a gaseous fuel, 8:11991 (TG:GB)
Deposition
Zinc-electrode morphology in acid-battery electrolytes, 8:12458 (R:US)
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

ZINC OXIDES
Catalytic Effects
Catalysts for alcohols from biomass (C_2-C_4 alcohols), 8:11970 (R:US)
Kinetics and mechanism of methanol decomposition over zinc oxide, 8:11982 (R:US)
Methanol synthesis, 8:11984 (RA:US)

ZINC SULFATES
Pyrolysis
High-temperature solar hydrogen process. Final report, April 1, 1081-May 31, 1982, 8:12057 (R:US)

ZINC-AIR BATTERIES
Battery Separators
Development of improved separators for alkaline zinc batteries. Final report, 8:12455 (R:US)
Electrodes
Zinc-electrode morphology in acid-battery electrolytes, 8:12458 (R:US)

ZINC-BROMINE BATTERIES
Electrodes
Zinc-electrode morphology in acid-battery electrolytes, 8:12458 (R:US)
Performance
Design of bipolar, flowing-electrolyte zinc-bromine electric-vehicle-battery systems, 8:12651 (R:US)
Specifications
Design of bipolar, flowing-electrolyte zinc-bromine electric-vehicle-battery systems, 8:12651 (R:US)

ZINC-CHLORINE BATTERIES
Electrodes
Zinc-electrode morphology in acid-battery electrolytes, 8:12458 (R:US)

ZION STATION UNIT-2
See ZION-2 REACTOR

ZION-2 REACTOR
Reactor Operation
Selected safety-related events reported in May and June 1982, 8:12427 (J:US)
Reactor Safety
Selected safety-related events reported in May and June 1982, 8:12427 (J:US)

ZIRCON
Classification
Preliminary investigation of accessory zircons from volcanic and sedimentary rocks from Clear Lake, 8:12253 (RA:US)

ZIRCONIUM
Emission Spectroscopy
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Sacramento quadrangle, California, 8:11827 (R:US)
National uranium resource evaluation program: hydrogeochemical and stream sediment reconnaissance basic data for Fresno quadrangle, California, 8:11828 (R:US)
Mass Spectroscopy
Improvement in the analysis of ashes from coal by spark-source mass spectrography, 8:11678 (R:US)

ZIRCONIUM 90
Multipole Transitions
Effect the residual force spin components on the properties of the electrical type states in the spherical nuclei, 8:13326 (RA:SU:In Russian)

ZIRCONIUM BROMIDES
Oxidation
Synthesis and characterization of oxide interstitial derivatives of zirconium monochloride and monobromide, 8:12791 (R:US)

ZIRCONIUM CHLORIDES
Oxidation
Synthesis and characterization of oxide interstitial derivatives of zirconium monochloride and monobromide, 8:12791 (R:US)

ZIRCONIUM NITRIDES
Electronic Structure
Electron-energy-loss and ultraviolet-photoemission study of VN/sub x/, NbN/sub x/, and ZrN/sub x/, 8:12711 (R:US)

ZIRCONIUM OXIDES
Chemical Reactions
Synthesis and characterization of oxide interstitial derivatives of zirconium monochloride and monobromide, 8:12791 (R:US)

ZOOPLANKTON
Mortality
Larval mortality from offshore mixing as a link between precompetent and competent periods of development, 8:13076 (J:US)

ZYMOMONAS MOBILIS
Genetic Engineering
Conversion of cellulose to ethanol by mesophilic bacteria. Progress report and third year budget, 8:11971 (R:US)
Development of high alcohol tolerant organisms. I. Strain selection and screening. Annual report, 31 July 1981-1 August 1982, 8:11973 (R:US)

CONTRACT NUMBER INDEX

Numbers assigned to DOE contracts under which documents announced in this publication were prepared are included in this index.

Contract No.	*Abstract No.*	*Report No.*
AC01-76CS32393	Ahern-MacVittie-Hofmann and Goodwin Architects Ltd., Tempe, AZ (USA)	
	8:12174	CAPE—2772(15 Jun 1982).
AC01-76ET10349	United Technologies Corp., South Windsor, CT (USA). Power Systems Div.	
	8:12276	GTR—2913
AC01-76ET10555	Delaware Univ., Newark (USA)	
	8:11612	DOE/ET/10555—T1
AC01-78ET10159	UOP/SDC, Joint Venture, McLean, VA (USA)	
	8:11579	DOE/ET/10159—T25
	8:11600	DOE/ET/10159—T18
AC01-79CS30027	Automation Industries, Inc., Silver Spring, MD (USA). Vitro Labs. Div.	
	8:12013	SOLAR/0010—80/01
AC01-79ET21106	Springborn Labs., Inc., Enfield, CT (USA)	
	8:12119	DOE/ET/21106—T1
AC01-79PE70013	Charles River Associates, Inc., Boston, MA (USA)	
	8:11789	CRA—489.06-Vol.1
	8:11790	CRA—489.06-Vol.2
AC01-79RG10076	Automated Management Systems, Lanham, MD (USA)	
	8:12271	DOE/RG/10076—T1
AC01-80CS21348	Hansen (Derek) and Associates, Inc., San Francisco, CA (USA)	
	8:12548	DOE/CS/21348—T1
AC01-80CS24317	National Center for Resource Recovery, Inc., Washington, DC (USA)	
	8:12633	DOE/CS/24317—2
AC01-80ET10683	Scientific Systems, Inc., Cambridge, MA (USA)	
	8:11932	DOE/EIA/10683—T1
	Scientific Systems, Inc., Kensington, MD (USA)	
	8:12333	DOE/EIA/10683—T2
AC01-80ET15614	Avco-Everett Research Lab., Inc., Everett, MA (USA)	
	8:12515	DOE/ET/15614—2
AC01-80EV10354	Mitre Corp., McLean, VA (USA). METREK Div.	
	8:12019	MTR—80W215-02
	8:12020	MTR—80W215-03
	8:12021	MTR—82W59
AC01-80RG10295	Barry (Theodore) and Associates, Washington, DC (USA)	
	8:12504	DOE/RG/10295—1
AC01-81CS24456	Opportunity Systems, Inc., Washington, DC (USA)	
	8:12634	DOE/CS/24456—2
AC01-81EV10450	Mueller Associates, Inc., Baltimore, MD (USA)	
	8:12045	DOE/EV/10450—T1
	8:12046	DOE/EV/10450—T2
	8:12047	DOE/EV/10450—T3
	8:13026	DOE/EV/10450—T4
AC01-81EV10502	Little (Arthur D.), Inc., Cambridge, MA (USA)	
	8:13027	DOE/EV/10502—2
	8:13080	DOE/EV/10502—3
AC01-81FE00080	Bituminous Coal Research, Inc., Monroeville, PA (USA)	
	8:11731	DOE/FE/00080—7
AC01-81FE14185	Ketron, Inc., Pittsburgh, PA (USA)	
	8:11732	DOE/FE/14185—T4
AC01-82EP12040	Epidemiology Resources, Inc., Chestnut Hill, MA (USA)	
	8:13140	DOE/EP/12040—T1
AC01-82RG10572	Plett (Robert) Associates Ltd., Arlington, VA (USA)	
	8:11811	DOE/RG/10572—1
	8:11812	DOE/RG/10572—3-Vol.1
	8:11813	DOE/RG/10572—3-Vol.2
AC02-76CH00016	Brookhaven National Lab., Upton, NY (USA)	
	8:12458	BNL—32190
	8:12497	BNL—31364
	8:12520	BNL—32172
	Institut de Genie des Materiaux, Montreal, Quebec (Canada)	
	8:12659	BNL—30030
	Brookhaven National Lab., Upton, NY (USA)	
	8:12686	NUREG/CR—2317-Vol.2-No.1
	Ohio State Univ., Columbus (USA). Dept. of Chemical Engineering	
	8:12748	BNL—32132
	Brookhaven National Lab., Upton, NY (USA)	
	8:12749	BNL—32212
	8:12818	BNL—32211
	8:12864	BNL—32086
	8:12894	BNL—32239
	8:12899	BNL—32168
	8:12910	BNL—32169
	8:12911	BNL—32173
	8:12912	BNL—32237
	8:12913	BNL—32304
	8:12937	BNL—32087
	8:12938	BNL—32167
	8:12939	BNL—32175
	8:12943	BNL—32208
	8:13018	BNL—32178
	8:13019	BNL—51606
	8:13059	BNL—32255
	National Center for Analysis of Energy Systems, Upton, NY (USA)	
	8:13100	BNL—32275
	Brookhaven National Lab., Upton, NY (USA)	
	8:13117	BNL—32174
	8:13120	Proceedings of the National Academy of Sciences of the United States of America 79 1545-1
	8:13129	BNL—32297
	8:13174	National Cancer Institute Monograph NO. 60. 249-255 ([nd]).
	8:13176	BNL—30628
	State Univ. of New York, Stony Brook (USA)	
	8:13216	BNL—32210
	Brookhaven National Lab., Upton, NY (USA)	
	8:13253	BNL—32247
	Brandeis Univ., Waltham, MA (USA)	
	8:13254	BNL—32264

Contract No.	Abstract No.	Report No.
	Brookhaven National Lab., Upton, NY (USA)	
	8:13267	BNL—32188
	Columbia Univ., New York (USA)	
	8:13268	BNL—32263
	Brookhaven National Lab., Upton, NY (USA)	
	8:13283	BNL—32143
	8:13284	BNL—32147
	8:13285	BNL—32230
	8:13321	BNL-NCS—28878
	8:13539	BNL—51432-Rev.A
	8:13570	Mathematical Programming Study 20 303-326 (1981).
AC02-76CH03000	**Fermi National Accelerator Lab., Batavia, IL (USA)**	
	8:12917	FERMILAB/TM—1148
	8:13258	FERMILAB-Conf—82/69-EXP
	8:13259	FERMILAB-CONF—82/87
	8:13260	FERMILAB-Conf—82/97-EXP
	8:13276	FERMILAB-Conf—82/86
	8:13405	FERMILAB-CONF—82/67-THY
AC02-76CH03073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
	8:13446	PPPL—1951
	8:13447	PPPL—1961
	8:13448	PPPL—1962
	8:13449	PPPL—1964
	8:13450	PPPL—1966
	8:13495	PPPL—1960
AC02-76ER01198	**Illinois Univ., Urbana (USA). Dept. of Ceramic Engineering**	
	8:12706	DOE/ER/01198—1395
	8:12707	DOE/ER/01198—1396
AC02-76ER01545	**Ohio State Univ., Columbus (USA). Dept. of Physics**	
	8:13271	DOE/ER/01545—325
AC02-76ER02172	**Cornell Univ., Ithaca, NY (USA). Materials Science Center**	
	8:12664	DOE/ER/02172—39
AC02-76ER02184	**Princeton Univ., NJ (USA)**	
	8:13349	DOE/ER/02184—T1
AC02-76ER03077	**New York Univ., NY (USA). Courant Inst. of Mathematical Sciences**	
	8:13413	DOE/ER/03077—176
AC02-76ER03130	**Brown Univ., Providence, RI (USA). Dept. of Physics**	
	8:13247	BROWN/HET—480
AC02-76ER03227	**Harvard Univ., Cambridge, MA (USA). Div. of Applied Sciences**	
	8:13272	DOE/ER/03227—76
AC02-76ER03285	**Johns Hopkins Univ., Baltimore, MD (USA). Dept. of Physics**	
	8:13286	DOE/ER/03285—44
AC02-76ET11292	**Thermo Electron Corp., Waltham, MA (USA)**	
	8:12519	TE—4258-442-82
AC02-76ET20279	**Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.**	
	8:12109	DOE/ET/20279—170
	8:12110	DOE/ET/20279—180-Vol.5
	Texas Univ., Arlington (USA)	
	8:12111	DOE/ET/20279—222
AC02-76ET37240	**Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering**	
	8:12314	DOE/ET/37240—98TR-Pt.1
	8:12315	DOE/ET/37240—98TR-Pt.2
AC02-76ET52040	**Illinois Univ., Urbana (USA). Fusion Studies Lab.**	
	8:13419	CONF-821124—12
	8:13420	CONF-821124—14
	8:13466	CONF-821124—13
AC02-76EV00790	**Univ. of Illinois, Urbana**	
	8:13121	Plant Science Letters 24 97-104 (1982).
AC02-76EV03221	**Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry**	
	8:12820	DOE/EV/03221—75
	8:13006	DOE/EV/03221—73
	Hebrew Univ., Jerusalem (Israel)	
	8:13180	DOE/EV/03221—74
AC02-76EV03280	**Johns Hopkins Univ., Baltimore, MD**	
	8:13114	Journal of Molecular Biology 153 841-870 (1981).
	8:13115	Journal of Molecular Biology 153 871-896 (1981).
AC02-76EV03380	**New York Univ., NY (USA). Dept. of Environmental Medicine**	
	8:13141	DOE/EV/03380—38
AC02-76EV03490	**Univ. of Rochester, NY**	
	8:13137	Anatomical Record 203 265-272 (1982).
AC02-76EV03522	**Memorial Sloan-Kettering Cancer Center, New York (USA)**	
	8:13380	DOE/EV/03522—25
AC02-76EV03566	**Woods Hole Oceanographic Inst., MA**	
	8:13093	Journal of Marine Research 39 NO. 1. 119-138 (1981).
AC02-77CH00178	**Solar Energy Research Inst., Golden, CO (USA)**	
	8:11956	SERI/TP—235-1814
	8:11983	SERI/CP—234-1590
	8:12092	SERI/PR—234-1850
	Rockwell International Corp., Thousand Oaks, CA (USA)	
	8:12093	SERI/PR—8002-1-T3
	Harvard Univ., Cambridge, MA (USA)	
	8:12094	SERI/PR—9318-2-T5
	Minnesota Univ., St. Paul (USA)	
	8:12095	SERI/STR—231-1819
	Florida Univ., Gainesville (USA)	
	8:12096	SERI/STR—231-1820
	Solar Energy Research Inst., Golden, CO (USA)	
	8:12097	SERI/TR—332-417
	Motorola, Inc., Phoenix, AZ (USA)	
	8:12098	SERI/TR—9100-1-T4
	Washington Univ., Seattle (USA)	
	8:12181	SERI/STR—231-1812
	Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Aeronautics and Astronautics	
	8:12260	SERI/TR—635-1247
	Solar Energy Research Inst., Golden, CO (USA)	
	8:12640	DOE/NBM—2021934
	8:12816	SERI-TP—233-1697
	8:12942	SERI/TP—215-1758
AC02-77ET13046	**Energy Impact Associates, Inc., Pittsburgh, PA (USA)**	
	8:11682	DOE/ET/13046—T82
AC02-77ET25402	**Stanford Univ., CA (USA). Dept. of Materials Science and Engineering**	
	8:12460	DOE/ET/25402—T1
AC02-77ET34209	**General Electric Co., San Jose, CA (USA). Nuclear Engineering Div.**	
	8:12291	GEAP—22077
	General Electric Co., San Jose, CA (USA). Nuclear Fuel and Special Projects Div.	
	8:12292	GEAP—22211
	General Electric Co., San Jose, CA (USA). Nuclear Energy Div.	
	8:12293	GEAP—24381
AC02-77EV04267	**Massachusetts Inst. of Tech., Cambridge (USA)**	
	8:13181	DOE/EV/04267—06
AC02-78ER04900	**Yale Univ., New Haven, CT (USA)**	
	8:12802	DOE/ER/04900—3
AC02-78ET29101	**Purdue Univ., Lafayette, IN (USA)**	
	8:12285	DOE/ET/29101—33
AC02-78ET29232	**Sargent and Lundy, Chicago, IL (USA)**	
	8:12449	EPRI-EM—2351-Vol.4

Contract No.	Abstract No.	Report No.
AC02-78ET51013	Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center	
	8:13423	DOE/ET/51013—59
	8:13474	DOE/ET/51013—62
AC02-79CS50108	Mellon Inst., Arlington, VA (USA). Energy Productivity Center	
	8:12612	DOE/CS/50108—1
AC02-79ER10343	Minnesota Univ., Minneapolis (USA). Dept. of Mechanical Engineering	
	8:12452	DOE/ER/10343—04
AC02-79ER10428	Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Materials Engineering	
	8:12665	DOE/ER/10428—4
	8:12666	DOE/ER/10428—T3
	State Univ. of New York, Stony Brook (USA)	
	8:12708	DOE/ER/10428—T2
AC02-79ER10485	Pittsburgh Univ., PA (USA)	
	8:12776	DOE/ER/10485—T2
AC02-79ER10496	Iowa Univ., Iowa City (USA)	
	8:12916	DOE/ER/10946—3
AC02-79ER10528	Kansas Univ., Lawrence (USA). Dept. of Physics and Astronomy	
	8:13273	DOE/ER/10528—3
AC02-79ET10815	Tennessee Univ., Tullahoma (USA). Space Inst.	
	8:12513	DOE/ET/10815—75
	8:12514	DOE/ET/10815—77
AC02-79ET15420	Rutgers--the State Univ., New Brunswick, NJ (USA). Dept. of Electrical Engineering	
	8:12517	DOE/ET/15420—T1
AC02-79ET29354	Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center	
	8:12668	DOE/ET/29354—3
AC02-79ET34013	C-E Power Systems, Windsor, CT (USA)	
	8:12334	DOE/ET/34013—5
AC02-79ET34015	Dow Chemical U.S.A., Freeport, TX. Texas Div.	
	8:12302	DOE/ET/34015—4
AC02-80CS30149	Northern Energy Corp., Boston, MA (USA)	
	8:12637	DOE/CS/30149—5
AC02-80CS83001	Lehigh Univ., Bethlehem, PA (USA). Center for Surface and Coatings Research	
	8:11970	DOE/CS/83001—T1
AC02-80ER10556	Brown Univ., Providence, RI (USA). Div. of Engineering	
	8:13402	DOE/ER/10556—92
AC02-80ER10587	Chicago Univ., IL (USA). Enrico Fermi Inst.	
	8:13274	DOE/ER/10587—2
AC02-80ER10624	Wyoming Univ., Laramie (USA). Dept. of Chemistry	
	8:12804	DOE/ER/10624—3
AC02-80ER10740	State Univ. of New York, Stony Brook (USA). Dept. of Materials Science and Engineering	
	8:12667	DOE/ER/10740—8
AC02-80ER10765	Arizona State Univ., Tempe	
	8:13222	American Mineralogist 67 NO. 7-8. 718-724 (Jul 1982).
AC02-80ET25207	California Univ., Los Angeles (USA). School of Engineering and Applied Science	
	8:12814	DOE/ET/25207—1
AC02-80ET34030	Combustion Engineering, Inc., Windsor, CT (USA). Power Systems Group	
	8:12303	DOE/ET/34030—4
AC02-81ER10841	Princeton Univ., NJ (USA). Dept. of Statistics	
	8:13414	DOE/ER/10841—5
AC02-81ER10878	Massachusetts Univ., Amherst (USA)	
	8:11971	DOE/ER/10878—T1
AC02-81ER10881	Temple Univ., Philadelphia, PA (USA)	
	8:12733	DOE/ER/10881—T1
AC02-81ER60015	Columbia Univ., New York, NY	
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AC02-82CH10116	North Carolina State Univ., Raleigh (USA). Dept. of Mechanical and Aerospace Engineering	
	8:12134	DOE/CH/10116—1
AC02-82CH10122	ESG, Inc., Atlanta, GA (USA)	
	8:12135	DOE/CH/10122—7
AC02-82ER12028	Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Botany	
	8:13126	DOE/ER/12028—1
AC02-82ER12064	Harvard Univ., Cambridge, MA (USA)	
	8:12734	DOE/ER/12064—1
AC02-82ER53136	Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy	
	8:13421	DOE/ER/53136—2
AC02-82ER53140	Grumman Aerospace Corp., Princeton, NJ (USA)	
	8:13422	DOE/ER/53140—5
AC03-76SF00012	California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences	
	8:12125	UCLA—12/1385
	8:12126	UCLA—12/1388
AC03-76SF00098	California State Univ., Long Beach (USA). Dept. of Geological Sciences	
	8:12201	LBL—15073
	Lawrence Berkeley Lab., CA (USA)	
	8:12561	LBL—15251
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	8:12685	LBL—14766
	8:12792	LBL—15156
	8:12852	LBL—14859
	8:12896	LBL—14624
	8:12897	LBL—15225
	8:12907	LBL—15089
	8:12925	LBL—14623
	8:12973	LBL—14456
	8:12974	LBL—14916
	8:13119	Proceedings of the National Academy of Sciences of the United States of America 79 NO. 15
	8:13138	LBL—14234
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	8:13297	LBL—14980
	Lawrence Berkeley Lab., CA (USA)	
	8:13335	LBL—12811
	8:13404	LBL—15220
	8:13443	LBL—14464
	8:13535	LBL—13840
	8:13555	LBL—14471
AC03-76SF00515	Stanford Linear Accelerator Center, CA (USA)	
	8:12932	SLAC-PUB—2963
	8:12933	SLAC-TN—82-3
	8:12935	CAPE—2776(1982).
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	Colorado Univ., Boulder (USA). Dept. of Physics	
	8:12940	SLAC-PUB—2986
	Stanford Linear Accelerator Center, CA (USA)	
	8:12941	SLAC-Trans—0199(Sep 1982).
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Contract No.	Abstract No.	Report No.
AC03-76SF01012	Univ. of Southern California, Los Angeles	
	8:13116	Journal of Experimental Medicine 152 1527-1536 (Dec 1980).
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AC03-76SF90438	Science Applications, Inc., La Jolla, CA (USA)	
	8:12525	SAN—1492-1
AC03-79SF10499	McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)	
	8:12120	DOE/SF/10499—46
	8:12121	MDC-G—8544-Vol.3
	8:12127	CAPE—2771(Jul 1982).
	8:12128	CAPE—2770
AC03-80ER10697	SRI International, Menlo Park, CA (USA). Biotechnology Research Dept.	
	8:13134	DOE/ER/10697—T1
AC03-81SF11525	Institute of Gas Technology, Chicago, IL (USA)	
	8:12057	DOE/SF/11525—T2
AC04-76DP00053	Monsanto Research Corp., Miamisburg, OH (USA). Mound	
	8:11890	MLM—3028
	8:11940	MLM—3009
	8:12719	Scripta Metallurgica 933-938 (1982).
	8:13486	MLM—3029
AC04-76DP00487	Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)	
	8:13009	MHSMP—82-41
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AC04-76DP00613	Bendix Corp., Kansas City, MO (USA)	
	8:12722	BDX—613-2848
	8:12729	BDX—613-2874(Nov 1982).
	8:12747	BDX—613-2865
	8:13005	BDX—613-2854
	8:13374	BDX—613-2876
	8:13538	BDX—613-2886
AC04-76DP00656	General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.	
	8:12451	GEPP-TIS—696
AC04-76DP00789	Sandia National Labs., Livermore, CA (USA)	
	8:11771	SAND—82-8657
	Sandia National Labs., Albuquerque, NM (USA)	
	8:11852	SAND—80-1943
	8:11853	SAND—82-7066
	8:11907	SAND—82-0460
	8:11908	SAND—82-0664/1
	8:11909	SAND—82-1439C
	8:11910	SAND—82-2259C
	8:11911	SAND—82-2866C
	8:12085	SAND—82-7119
	Mission Research Corp., Albuquerque, NM (USA)	
	8:12086	SAND—82-7128
	BDM Corp., Albuquerque, NM (USA)	
	8:12087	SAND—82-7134
	Boeing Computer Services Co., Seattle, WA (USA)	
	8:12112	SAND—81-7080/4
	8:12113	SAND—81-7083/1
	8:12114	SAND—81-7085/14
	8:12115	SAND—81-7086/14
	8:12116	SAND—81-7087/3
	8:12117	SAND—81-7087/6
	General Electric Co., Philadelphia, PA (USA)	
	8:12118	SAND—81-7188
	Sandia National Labs., Albuquerque, NM (USA)	
	8:12122	SAND—80-2560
	8:12123	SAND—82-8027
	8:12180	SAND—82-1600
	8:12247	SAND—81-2124
	8:12248	SAND—82-2377
	Texas Tech Univ., Lubbock (USA). Dept. of Geosciences	
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Contract No.	Abstract No.	Report No.
	Sandia National Labs., Albuquerque, NM (USA)	
	8:12351	NUREG/CR—2927
	8:12416	NUREG/CR—2899
	Ktech Corp., Albuquerque, NM (USA)	
	8:12419	SAND—82-2186C
	Sandia National Labs., Albuquerque, NM (USA)	
	8:12469	SAND—82-1222
	8:12518	SAND—82-1885
	Exxon Research and Engineering Co., Linden, NJ (USA)	
	8:12651	SAND—82-7092C
	Sandia National Labs., Albuquerque, NM (USA)	
	8:12688	SAND—82-1279C
	8:12689	SAND—82-1524
	8:12715	SAND—82-1483C
	8:12725	SAND—82-1903C
	8:12741	SAND—82-1847C
	Sandia National Labs., Livermore, CA (USA)	
	8:12832	SAND—82-8882
	Sandia National Labs., Albuquerque, NM (USA)	
	8:12870	SAND—77-1332-Rev.
	8:12871	SAND—81-0510
	Sandia Labs., Albuquerque, NM (USA)	
	8:12872	SAND—81-1390
	Sandia National Labs., Albuquerque, NM (USA)	
	8:12873	SAND—82-0435
	8:12882	SAND—82-1546
	8:12883	SAND—82-1548C
	8:12886	SAND—82-1874C
	8:12931	SAND—82-2393
	8:13004	IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science N
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	8:13014	SAND—81-1871
	8:13157	SAND—82-1550
	8:13184	NUREG/CR—2650
	8:13213	SAND—82-1711C
	8:13219	SAND—82-1314
	8:13220	SAND—82-2187C
	8:13500	SAND—82-1398-Vol.6-No.1
	8:13557	NUREG/CR—1935
	8:13560	SAND—82-0930
	8:13561	SAND—82-2175
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AC04-76DP03533		
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	Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant	
	8:12717	RFP-Trans—352(Dec 1982).
AC04-78CS14287	Honeywell, Inc., Minneapolis, MN (USA)	
	8:12176	DOE/CS/14287—T2
AC04-78CS30131	Owens-Illinois, Inc., Toledo, OH (USA)	
	8:12177	DOE/CS/30131—T1
AC04-78CS34285	Owens-Illinois, Inc., Toledo, OH (USA)	
	8:12178	DOE/CS/34285—T1
AC04-79AL10563	Republic Geothermal, Inc., Santa Fe Springs, CA (USA)	
	8:12242	DOE/AL/10563—T15
	Vetter Research, Costa Mesa, CA (USA)	
	8:12243	DOE/AL/10563—T16
AC04-79ET15397	Science Applications, Inc., La Jolla, CA (USA)	
	8:12646	DOE/ET/15397—T5
AC05-76OR00033	Oak Ridge Associated Universities, Inc., TN (USA). Manpower Education, Research and Training Div.	
	8:11738	ORAU—207
	Oak Ridge Associated Universities, Inc., TN (USA)	
	8:12466	ORAU—206
	8:13037	DOE/OR/00033—T12

Contract No.	Abstract No.	Report No.
AC05-77CS40093	Gulf Research and Development Co., Pittsburgh, PA (USA)	
	8:11808	ORO—5262-5
AC05-79CS20544	Duke Univ., Durham, NC (USA)	
	8:12631	DOE/CS/20544—1
AC06-76ER01388	Washington Univ., Seattle (USA). Dept. of Physics	
	8:13292	DOE/ER/01388—883
AC06-76FF02170	Hanford Engineering Development Lab., Richland, WA (USA)	
	8:11937	HEDL-SA—2765-FP
	8:12370	HEDL-SA—2719
	8:12398	HEDL-SA—2790
	8:13481	HEDL-SA—2692-FP
	8:13482	HEDL-SA—2729S
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AC06-76RL01830	Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation	
	8:11892	ONWI—2-Suppl.3
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	Battelle Columbus Labs., OH (USA)	
	8:11895	ONWI—251
	General Atomic Co., San Diego, CA (USA)	
	8:11896	ONWI—334-Vol.2-App.
	Woodward-Clyde Consultants, San Francisco, CA (USA)	
	8:11897	ONWI—400
	Pacific Northwest Lab., Richland, WA (USA)	
	8:11899	PNL—4250-2
	8:11900	PNL—4490
	8:11901	PNL-SA—10529
	8:11902	PNL-SA—10534
	8:11903	PNL-SA—10620
	8:11904	PNL-SA—10649
	8:11922	DOE/UMT—0212
	8:11924	NUREG/CR—2894
	Battelle Columbus Labs., OH (USA)	
	8:11925	ONWI—348
	Pacific Northwest Lab., Richland, WA (USA)	
	8:11941	PNL-SA—10574
	8:12067	PNL-SA—7939-Rev.3
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	8:12411	NUREG/CR—2526
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	8:12418	PNL-SA—9990
	8:12450	PNL-SA—7982
	8:12565	PNL—4549
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	Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Structures Lab.	
	8:12740	ONWI—342
	Pacific Northwest Lab., Richland, WA (USA)	
	8:12760	PNL-SA—10560
	Lawrence Berkeley Lab., CA (USA)	
	8:12825	ONWI—399
	Pacific Northwest Lab., Richland, WA (USA)	
	8:12881	PNL-SA—10523
	8:13023	PNL—4406
	8:13024	PNL-SA—10917
	8:13030	PNL-SA—8281
	8:13031	PNL-SA—10558
	8:13044	NUREG/CR—3004
	8:13045	PNL-SA—10170
	8:13046	PNL-SA—10213
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	8:13075	
	8:13089	NUREG/CR—2423
	8:13090	NUREG/CR—2425
	8:13142	DOE/RL—82-4
	Hanford Environmental Health Foundation, Richland, WA (USA)	
	8:13143	DOE/RL—82-6
	8:13144	DOE/RL—82-7
	Pacific Northwest Lab., Richland, WA (USA)	
	8:13145	DOE/RL—82-8
	8:13146	DOE/RL—82-9
	8:13147	DOE/RL—82-10
	8:13148	DOE/RL—82-11
	8:13149	DOE/RL—82-12
	8:13150	DOE/RL—82-13
	8:13151	DOE/RL—82-14
	8:13156	PNL-SA—9576
	8:13194	PNL—3258
	8:13392	PNL-SA—8304
	8:13393	PNL-SA—9950
	8:13408	PNL—4580
	8:13558	PNL-SA—8409
	8:13559	PNL-SA—10897
AC06-77CS20009	Tacoma, City of, WA (USA)	
	8:12627	DOE/CS/20009—1
	8:12628	DOE/CS/20009—2
AC06-77RL01030	Woodward-Clyde Consultants, San Francisco, CA (USA)	
	8:11905	RHO-BW-CR—129P
	Rockwell International Corp., Richland, WA (USA). Energy Systems Group	
	8:11906	RHO-BW-SA—269-P
	Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations	
	8:13091	RHO-BW-SA—198-P
AC06-81ER40048	Washington Univ., Seattle (USA)	
	8:13227	DOE/ER/40048—28-L2
	Washington Univ., Seattle (USA). Nuclear Physics Lab.	
	8:13228	DOE/ER/40048—30-L2
	Washington Univ., Seattle (USA)	
	8:13275	DOE/ER/40048—17-P2
	Washington Univ., Seattle (USA). Dept. of Physics	
	8:13288	DOE/ER/40048—20P2
	Washington Univ., Seattle (USA). Nuclear Physics Lab.	
	8:13315	DOE/ER/40048—25-L2
	Washington Univ., Seattle (USA). Dept. of Physics	
	8:13316	DOE/ER/40048—27-L2
	Washington Univ., Seattle (USA). Nuclear Physics Lab.	
	8:13344	DOE/ER/40048—11-L2
	Washington Univ., Seattle (USA). Dept. of Physics	
	8:13355	DOE/ER/40048—21-L2
AC07-76ID01570	EG and G Idaho, Inc., Idaho Falls (USA)	
	8:11647	EGG-M—22482
	8:11851	DOE/LLW—15T
	8:11868	DOE/LLW—6T
	8:11869	DOE/LLW—6T(Oct 1982).
	8:11870	DOE/LLW—6T(Oct 1982).
	8:11871	DOE/LLW—6T(Oct 1982).
	Purdue Univ., Lafayette, IN (USA). School of Health Sciences	
	8:11872	DOE/LLW—12T
	EG and G Idaho, Inc., Idaho Falls (USA)	
	8:11882	EGG-M—22882
	8:11883	EGG-TIO-M—02082
	Idaho National Engineering Lab., Idaho Falls (USA)	
	8:11933	EGG-WM—5792-Rev.1
	EG and G Idaho, Inc., Idaho Falls (USA)	
	8:12289	EGG-M—20482
	Idaho National Engineering Lab., Idaho Falls (USA)	
	8:12339	EGG-PHYS—6003
	8:12387	EGG-M—18582
	EG and G Idaho, Inc., Idaho Falls (USA)	
	8:12388	EGG-M—24282
	Idaho National Engineering Lab., Idaho Falls (USA)	
	8:12389	EGG-SD—5159

Contract No.	Abstract No.	Report No.
	Pacific Northwest Lab., Richland, WA (USA)	
	8:12394	GEND—012
	Idaho National Engineering Lab., Idaho Falls (USA)	
	8:12414	NUREG/CR—2701
	EG and G Idaho, Inc., Idaho Falls (USA)	
	8:12670	EGG-M—15682
	Idaho National Engineering Lab., Idaho Falls (USA)	
	8:12878	EGG-FM—6046
	EG and G Idaho, Inc., Idaho Falls (USA)	
	8:12879	EGG-M—15782
	8:12948	EGG-PHYS—5890
	Idaho National Engineering Lab., Idaho Falls (USA)	
	8:13209	EGG-PHYS—6145
AC07-77CS40327	**Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center**	
	8:12620	DOE/CS/40327—T3
	8:12621	DOE/CS/40327—T4
AC08-76NV00410	**Science Applications, Inc., Pleasanton, CA (USA)**	
	8:11873	DOE/NV/00410—68
AC08-76NV01183	**EG and G, Inc., Goleta, CA (USA). Energy Measurements Group**	
	8:12731	CONF-821107—41
	EG and G, Inc., Los Alamos, NM (USA)	
	8:12846	EGG—1183-5101
	EG and G, Inc., Goleta, CA (USA)	
	8:12946	CONF-821011—41
	Pacific Northwest Lab., Richland, WA (USA)	
	8:12980	PNL-SA—9950(Oct 1981).
	EG and G Idaho, Inc., Idaho Falls (USA)	
	8:13039	EGG—1183-1837
	8:13064	EGG—1183-1824
AC08-78DP40030	**KMS Fusion, Inc., Ann Arbor, MI (USA)**	
	8:13471	DOE/DP/40030—4
AC08-80ET27217	**Technadril - Fenix and Scisson, Houston, TX (USA)**	
	8:12197	DOE/ET/27217—2-Vol.1
	8:12244	DOE/ET/27217—1
AC08-81DP40162	**MPB Technologies, Inc., Ste-Anne-de-Bellevue, Quebec (Canada)**	
	8:13467	CONF-821128—2
AC08-81NV10194	**GeoEnergy Corp., Las Vegas, NV (USA)**	
	8:12186	DOE/NV/10194—1
	8:12200	DOE/NV/10194—3
	CK GeoEnergy Corp., Las Vegas, NV (USA)	
	8:12229	DOE/NV/10194—2
AC08-82DP40152	**KMS Fusion, Inc., Ann Arbor, MI (USA)**	
	8:11944	KMSF-U—1266
AC08-82NV10249	**CER Corp., Las Vegas, NV (USA)**	
	8:11817	DOE/NV/10249—3
AC08-82NV10250	**Westinghouse Electric Corp., Mercury, NV (USA). Advanced Energy Systems Div.**	
	8:11874	DOE/NV/10250—4
	8:11875	DOE/NV/10250—5
AC09-76SR00001	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**	
	8:11876	DP—1640
	8:11877	DP—1645
	8:11878	DP-MS—82-8
	8:11879	DP-MS—82-40
	8:11880	DP-MS—82-42
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant	
	8:11881	DPSP—79-1003(Del.)
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.	
	8:11947	DPST—82-854
	8:11949	DP-MS—82-49
	8:11950	DPST—82-128-2
	8:11951	DPST—82-813
	8:11952	DPST—82-839

Contract No.	Abstract No.	Report No.
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant	
	8:11953	DPST—82-842
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.	
	8:12669	DP-MS—82-21
	8:12752	DP-MS—82-76
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant	
	8:13038	DPSPU—82-30-3
	Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.	
	8:13096	DPST—82-969
	8:13547	DP-MS—82-48
AC09-80ET47916	**Southern States Energy Board, Atlanta, GA (USA)**	
	8:11850	DOE/ET/47916—1-Vol.4
AC12-76SN00052	**Knolls Atomic Power Lab., Schenectady, NY (USA)**	
	8:12683	KAPL—4135
AC13-76GJ01664	**Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.**	
	8:11829	GJBX—25-82
	Oak Ridge Gaseous Diffusion Plant, TN (USA)	
	8:11830	GJBX—165-82
	Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.	
	8:11831	GJBX—166-82
	Oak Ridge Gaseous Diffusion Plant, TN (USA)	
	8:11832	GJBX—167-82
	Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.	
	8:11833	GJBX—169-82
	Oak Ridge Gaseous Diffusion Plant, TN (USA)	
	8:11834	GJBX—170-82
	Union Carbide Corp., Oak Ridge, TN (USA). Nuclear Div.	
	8:11835	GJBX—172-82
	Oak Ridge Gaseous Diffusion Plant, TN (USA)	
	8:11836	GJBX—173-82
AC13-79GJ01692	**High Life Helicopters, Inc., Puyallup, WA (USA)**	
	8:11838	GJBX—196-82-Vol.1
	8:11839	GJBX—196-82-Vol.2A
	8:11840	GJBX—196-82-Vol.2B
	8:11841	GJBX—196-82-Vol.2C
	8:11842	GJBX—196-82-Vol.2D
AC18-80FC10200	**Radian Corp., Austin, TX (USA)**	
	8:11683	DOE/FC/10200—T4
	8:12282	DOE/FC/10200—T5
AC18-80FC10225	**Southern Research Inst., Birmingham, AL (USA)**	
	8:12281	DOE/FC—1009
AC18-81FC10297	**Georgia Inst. of Tech., Atlanta (USA)**	
	8:11684	DOE/FC/10297—T4
AC19-78BC10102	**Bonner and Moore Management Science, Houston, TX (USA)**	
	8:11809	DOE/BC/10102—1
AC19-79BC10100	**Geochem Research, Inc., Houston, TX (USA)**	
	8:11796	DOE/BC/10100—4
AC20-79ET14102	**Institute of Gas Technology, Chicago, IL (USA)**	
	8:11825	DOE/ET/14102—4
AC21-79MC12135	**Systems, Science and Software, La Jolla, CA (USA)**	
	8:11660	SSS-R—81-4685-Vol.1
	8:11661	SSS-R—81-4942-Vol.2
AC21-80MC14101	**Jenike and Johanson, Inc., North Billerica, MA (USA)**	
	8:11752	DOE/MC/14101—1126

Contract No.	Abstract No.	Report No.
AC21-80MC14273	Mechanical Technology, Inc., Latham, NY (USA). Research and Development Div.	
	8:11624	DOE/MC/14273—1318
AC21-80MC14705	Institute of Gas Technology, Chicago, IL (USA)	
	8:11625	DOE/MC/14705—3
AC21-81FE05147	McKee (Davy) Corp., Cleveland, OH (USA)	
	8:11620	DOE/FE/05147—T11
AC21-81FE15066	United Technologies Corp., South Windsor, CT (USA). Power Systems Div.	
	8:11621	DOE/FE/15066—1199
AC21-81MC16024	Westinghouse Research and Development Center, Pittsburgh, PA (USA)	
	8:11627	DOE/MC/16024—T4
AC21-81MC16140	Alabama Univ., Tuscaloosa (USA). Dept. of Mineral Engineering	
	8:11797	DOE/MC/16140—T2
AC21-81MC16229	Florida State Univ., Tallahassee (USA). Dept. of Physics	
	8:11685	DOE/MC/16229—T5
AC21-81MC16463	Michigan Univ., Ann Arbor (USA). Dept. of Geological Sciences	
	8:11816	DOE/MC/16463—1324
AC22-76ET10587	Pennsylvania State Univ., University Park (USA). Coal Research Section	
	8:11613	DOE/ET/10587—T1-Pt.3
AC22-77ET12457	Bendix Corp., Englewood, CO (USA). Energy and Environmental Technology Dept.	
	8:12845	DOE/ET/12457—T10
AC22-78ET12103	Filtrol Corp., Los Angeles, CA (USA)	
	8:11615	DOE/ET/12103—T4
AC22-79ET14801	Air Products and Chemicals, Inc., Allentown, PA (USA)	
	8:11616	DOE/ET/14801—30
AC22-79ET14803	Amoco Oil Co., Naperville, IL (USA). Research and Development Dept.	
	8:11617	DOE/ET/14803—T7
AC22-79ET14804	Lummus Co., Bloomfield, NJ (USA)	
	8:11618	DOE/ET/14804—Q7
AC22-79ET14809	Brigham Young Univ., Provo, UT (USA)	
	8:11960	DOE/ET/14809—12
AC22-79ET14880	Delaware Univ., Newark (USA). Dept. of Chemical Engineering	
	8:11619	DOE/ET/14880—T2
AC22-80PC30076	United Coal Co., Bristol, VA (USA)	
	8:11753	DOE/PC/30076—T4
AC22-80PC30080	Gulf Research and Development Co., Pittsburgh, PA (USA)	
	8:11628	DOE/PC/30080—8
AC22-80PC30205	McDonnell Douglas Electronics Co., St. Charles, MO (USA)	
	8:11733	DOE/PC/30205—4
AC22-80PC30298	Energy and Environmental Research Corp., Irvine, CA (USA)	
	8:11961	DOE/PC/30298—T9
AC22-80PC30300	Spectron Development Labs., Inc., Costa Mesa, CA (USA)	
	8:11766	DOE/PC/30300—T7
	8:12830	DOE/PC/30300—T6
AC22-81PC40009	Amoco Research Center, Naperville, IL (USA)	
	8:11629	DOE/PC/40009—T1
	8:11630	DOE/PC/40009—T2
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AC22-81PC40077	Union Carbide Corp., Tarrytown, NY (USA). Tarrytown Technical Center	
	8:11962	DOE/PC/40077—4
	8:11963	DOE/PC/40077—5
AC22-81PC41030	Pittsburgh Univ., PA (USA)	
	8:11638	DOE/PC/41030—T1
AC22-81PC41760	Kentucky Univ., Lexington (USA)	
	8:11639	DOE/PC/41760—T2
AC22-81PC42295	TRW, Inc., Redondo Beach, CA (USA)	
	8:11755	DOE/PC/42295—T5
AC22-81PC42681	Hittman Associates, Inc., Columbia, MD (USA)	
	8:11691	DOE/PC/42681—T1
AC22-81PC42682	Enviro Control, Inc., Rockville, MD (USA)	
	8:11640	DOE/PC/42682—T4
AC22-82PC50041	Catalytic, Inc., Wilsonville, AL (USA)	
	8:11641	DOE/PC/50041—11
AC22-82PC50254	Advanced Fuel Research, Inc., East Hartford, CT (USA)	
	8:11642	DOE/PC/50254—T1
AC22-82PC53030	Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering	
	8:11646	DOE/PC/53030—T1
AI01-76ET12548	Jet Propulsion Lab., Pasadena, CA (USA)	
	8:11716	DOE/ET/12548—13
	8:11717	DOE/ET/12548—15
AI01-76ET20307	Jet Propulsion Lab., Pasadena, CA (USA)	
	8:12179	DOE/JPL—1060-56
AI01-76ET20356	Jet Propulsion Lab., Pasadena, CA (USA)	
	8:12012	DOE/ET/20356—7
AI01-76ET20485	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	
	8:12015	DOE/NASA/20485—13
AI01-76ET53020	Naval Research Lab., Washington, DC (USA)	
	8:13488	NRL-MR—4985
AI01-77DP40042	Naval Research Lab., Washington, DC (USA)	
	8:13487	NRL-MR—4947
AI01-77ET10769	National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center	
	8:12516	DOE/NASA/10769—28
AI01-78CS54209	Jet Propulsion Lab., Pasadena, CA (USA)	
	8:12459	DOE/CS/54209—10
AI01-80ER10614	Jet Propulsion Lab., Pasadena, CA (USA)	
	8:12240	DOE/ER/10614—2
AI01-80ET17088	Engelhard Corp., Edison, NJ (USA). Engelhard Industries Div.	
	8:12522	DOE/NASA—0241-5
AI02-79CH00135	Naval Coastal Systems Center, Panama City, FL (USA)	
	8:12129	DOE/CH/00135—1
	8:12130	DOE/CH/00135—2
	8:12131	DOE/CH/00135—4
AI05-81OR20849	National Bureau of Standards, Washington, DC (USA)	
	8:12885	NBSIR—82-2552
AI08-78ET44802	Geological Survey, Denver, CO (USA)	
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AM01-76EI02295	Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.	
	8:12507	MIT/EL—81-031
AM03-76SF00010	Univ. of California, San Diego, La Jolla	
	8:13076	American Naturalist 118 NO. 1. 16-26 (Jul 1981).
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AM03-76SF00034	Scripps Inst. of Oceanography, La Jolla, CA	
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AP02-78ER05011		
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AS01-79EV10019	Mississippi State Univ., Mississippi State (USA)	
	8:13025	DOE/EV/10019—6
	Colorado State Univ., Fort Collins (USA). Dept. of Range Science	
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AS05-76ER02001	Florida State Univ., Tallahassee (USA)	
	8:12819	DOE/ER/02001—T1
AS05-76ER02408	North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy	
	8:12915	DOE/ER/02408—209

Contract No.	Abstract No.	Report No.
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	8:13235	DOE/ER/02408—212
	North Carolina Univ., Chapel Hill (USA). Dept. of Physics and Astronomy	
	8:13236	DOE/ER/02408—213
	North Carolina Univ., Chapel Hill (USA)	
	8:13294	DOE/ER/02408—208
AS05-76ER03443	**Maryland Univ., College Park (USA)**	
	8:13544	DOE/ER/03443—T1
AS05-76ER03956	**Tohoku Univ., Sendai (Japan)**	
	8:13257	DOE/ER/03956—T1
AS05-76ER04447	**Tennessee Univ., Knoxville (USA). Dept. of Chemistry**	
	8:12775	DOE/ER/04447—152
AS05-76EV04024	**Texas Univ., Houston (USA). Health Science Center**	
	8:13130	DOE/EV/04024—T1
AS05-77CS40095	**Texas A and M Univ., College Station (USA). Research Foundation**	
	8:12619	DOE/CS/40095—T1
AS05-77ER05490	**Louisiana State Univ., Baton Rouge (USA)**	
	8:13250	DOE/ER/05490—37
	Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy	
	8:13287	DOE/ER/05490—32
AS05-77ET52029	**Texas Univ., Austin (USA). Center for Electromechanics**	
	8:13464	CONF-771132—7
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	8:13470	CONF-7711157—1
AS05-77ET53042	**Texas Univ., Austin (USA). Fusion Research Center**	
	8:13475	DOE/ET/53042—13
AS05-78ET52025	**Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering and Health Physics**	
	8:13480	GTFR—36
AS05-78EV05888	**Florida State Univ., Tallahassee (USA). Inst. of Molecular Biophysics**	
	8:13182	DOE/EV/05888—05
AS05-78EV06023	**Texas Univ., Galveston (USA). Medical Branch**	
	8:13179	CONF-8103153—1
AS05-79ER10065	**Connecticut Univ., Storrs (USA). School of Engineering**	
	8:12645	DOE/ER/10065—3T
AS05-79ER10361	**Texas A and M Univ., College Station (USA). Center for Tectonophysics**	
	8:13217	DOE/ER/10361—3-3A
AS05-79ER10494	**Maryland Univ., College Park (USA). Dept. of Chemistry**	
	8:13322	DOE/ER/10494—4
AS05-79EV10306	**Florida State Univ., Tallahassee (USA)**	
	8:13083	DOE/EV/10306—T3
AS05-80ER10604	**Texas Tech Univ., Lubbock (USA). Dept. of Chemistry**	
	8:12803	DOE/ER/10604—3
AS05-80ER10638	**Texas Univ., Austin (USA). Dept. of Physics**	
	8:13295	DOE/ER/10638—3
AS05-80ER10662	**E.I. du Pont de Nemours and Company, Wilmington, DE**	
	8:12799	Journal of the American Chemical Society 104 NO. 9. 2645-2647 (5 May 1982).
AS05-80ER10714	**Tennessee Technological Univ., Cookeville (USA). Dept. of Physics**	
	8:13302	DOE/ER/10714—2
AS05-81ER40039	**Texas A and M Univ., College Station (USA). Dept. of Physics**	
	8:12947	DOE/ER/40039—6
AS05-82ER12044	**Southwest Research Inst., San Antonio, TX (USA)**	
	8:12709	DOE/ER/12044—1
AS07-79ET27204	**Kansas Geological Survey, Lawrence (USA)**	
	8:12215	DOE/ET/27204—T1-Vol.2-App.Sect.1
AS08-81DP40158	**California Univ., Los Angeles (USA)**	
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AS09-79ER10499	**Universitaet Goettingen, Germany**	
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AS09-80ER10671	**Clemson Univ., SC**	
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AS20-81LC10705	**Colorado State Univ., Fort Collins (USA)**	
	8:11622	DOE/LC/10705—T1
AS21-76ET12127	**Juniata Coll., Huntingdon, PA (USA)**	
	8:11824	ORO—5197-15
AT01-76CS40310	**Massachusetts Inst. of Tech., Cambridge (USA). Materials Processing Center**	
	8:12663	DOE/CS/40310—T1
AT01-80EV10373	**National Bureau of Standards, Washington, DC**	
	8:12809	Journal of the American Chemical Society 104 NO. 9. 2337-2345 (5 May 1982).
AT03-76ER70262	**Univ. of California, Santa Barbara**	
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AT03-76ER71294	**California Univ., Los Angeles (USA)**	
	8:11598	DOE/ER/71294—T2
AT03-76ET51011	**General Atomic Co., San Diego, CA (USA)**	
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AT03-80ER53091	**SRI International, Menlo Park, CA (USA)**	
	8:13472	DOE/ER/53091—T5
AT06-76EV72002	**Washington State Univ., Pullman (USA)**	
	8:13103	DOE/EV/72002—58
AT06-79ER10435	**Oregon Univ., Eugene (USA)**	
	8:12829	DOE/ER/10435—2
AT06-79EV10270	**Washington Univ., Seattle (USA). School of Medicine**	
	8:13118	DOE/EV/10270—3
AT06-81ER10879	**Washington Univ., Seattle (USA). Dept. of Genetics**	
	8:12042	DOE/ER/10879—2
AT06-81ER10939	**Oregon State Univ., Corvallis (USA). Dept. of Electrical and Computer Engineering**	
	8:12043	DOE/ER/10939—2
AT06-81EV10611	**Oregon State Univ., Corvallis (USA). School of Oceanography**	
	8:13081	DOE/EV/10611—2
AT06-82ER12017	**Los Alamos National Lab., NM (USA)**	
	8:13060	DOE/ER/12017—6
	Oregon State Univ., Corvallis (USA). School of Oceanography	
	8:13206	DOE/ER/12017—4
AT21-81MC16022	**West Virginia Univ., Morgantown (USA). Dept. of Chemical Engineering**	
	8:11626	DOE/MC/16022—1307
FC01-80ET23197	**Semix, Inc., Gaithersburg, MD (USA)**	
	8:12044	DOE/ET/23197—T9
FC02-80CS30339	**Associated Architects of Crested Butte, CO (USA)**	
	8:12152	DOE/CS/30339—T1
FC02-80CS30386	**Science Applications, Inc., Albuquerque, NM (USA)**	
	8:12153	DOE/CS/30386—T1
FC03-80RA50076	**Arizona Univ., Tucson (USA). Dept. of Chemical Engineering**	
	8:12185	DOE/RA/50076—1
	8:12230	DOE/RA/50076—2
	8:12231	DOE/RA/50076—3
	8:12232	DOE/RA/50076—4
	8:12233	DOE/RA/50076—5
	8:12234	DOE/RA/50076—6
	8:12235	DOE/RA/50076—7
	8:12236	DOE/RA/50076—8
FC05-77ET10069	**Exxon Research and Engineering Co., Florham Park, NJ (USA)**	
	8:11599	DOE/ET/10069—T21

Contract No.	Abstract No.	Report No.
FC07-79ID12030	North Dakota Univ., Grand Forks (USA). Engineering Experiment Station	
	8:12198	DOE/ID/12030—T3
FC07-79ID12044	Foundation Sciences, Inc., Portland, OR (USA)	
	8:13207	DOE/ID/12044—T1
	Geoscience Research Consultants, Moscow, ID (USA)	
	8:13208	DOE/ID/12044—T2
FC07-79ID12065	International Engineering Co., Inc., San Francisco, CA (USA)	
	8:12199	DOE/ID/12065—T1
FC07-79RA23211	F.W.E. Stapenhorst, Inc., Pointe Claire, Quebec (Canada)	
	8:11997	DOE/RA/23211—4
FG01-78CS54260	Union Coll., Schenectady, NY (USA)	
	8:12582	CONF-7807110—
FG01-78ET12231	Marquette Univ., Milwaukee, WI (USA)	
	8:12521	DOE/ET/12231—T1
FG01-79CS20234	Delaware State Solid Waste Authority, Dover (USA)	
	8:12629	DOE/CS/20234—2
FG01-79CS20291	Pacific Gas and Electric Co., San Francisco, CA (USA)	
	8:12630	DOE/CS/20291—4
FG01-79CS30013	Alabama Univ., Huntsville (USA). Kenneth E. Johnson Environmental and Energy Center	
	8:11781	DOE/CS/30013—U14
	8:12014	DOE/CS/30013—U12
	8:12635	DOE/CS/30013—U13
	8:12636	DOE/CS/30013—U16
FG01-79CS50045	Clarkson Coll. of Tech., Potsdam, NY (USA)	
	8:12650	DOE/CS/50045—T1
FG01-80CS24311	Denton, City of, TX (USA)	
	8:12632	DOE/CS/24311—1
FG01-80CS24448	Alliance to Save Energy, Washington, DC (USA)	
	8:12618	DOE/CS/24448—T1
FG01-80RG10268	National Regulatory Research Inst., Columbus, OH (USA)	
	8:12336	DOE/RG/10268—T2
FG01-81AD11257	California State Univ., Fresno (USA). Dept. of Criminology	
	8:12464	DOE/AD/11257—T1
FG01-81FE00103	Mississippi State Univ., Mississippi State (USA)	
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FG01-82ER54008	National Research Council, Washington, DC (USA). Committee on Magnetic Fusion	
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FG02-79R510148	Dwyer-Mercer County District Public Library, Celina, OH (USA)	
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FG02-80CS40337	Illinois Inst. of Tech., Chicago (USA). Dept. of Mechanical Engineering	
	8:12638	DOE/CS/40337—8
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FG02-80ER10125	Univ. of Michigan, Ann Arbor	
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FG02-80R510247	Sunpower, Inc., Athens, OH (USA)	
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FG02-80R510252	Stevens Point Area Co-op, WI (USA)	
	8:12155	DOE/R5/10252—2
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FG02-81AF92017	Reinke (Ralph G.), Wausau, WI (USA)	
	8:12617	DOE/AF/92017—T2
FG02-81ER10985	Connecticut Univ., Storrs (USA). Dept. of Physics	
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FG02-81R510311	Jacobson (Ray O.), Pengilly, MN (USA)	
	8:11996	DOE/R5/10311—2
FG02-81R510314	Gustavus Adolphus Coll., St. Peter, MN (USA). Dept. of Physics	
	8:12156	DOE/R5/10314—2
FG02-81R510316	Minnesota Univ., St. Paul (USA). Dept. of Agricultural Engineering	
	8:12655	DOE/R5/10316—T1
FG02-81R510327	Marshaus Berry Farms, Defiance, OH (USA)	
	8:12157	DOE/R5/10327—2
FG03-80CS22004	California Univ., Berkeley (USA). Dept. of Architecture	
	8:12560	DOE/CS/22004—T1
FG03-80SF11429	VTN Consolidated, Inc., Irvine, CA (USA)	
	8:12056	DOE/SF/11429—1
FG05-80IR11160	Bicycle Federation, Washington, DC (USA)	
	8:12613	DOE/IR/11160—T1
FG07-80RA50317	Synergy Systems Management Corp., Boca Raton, FL (USA)	
	8:12051	DOE/RA/50317—T1
FG07-80RA50320	American Cyanamid Co., Savannah, GA. Chemical Products Div.	
	8:12052	DOE/RA/50320—T1
FG07-80RA50328	Rochelle Energy Development, IL (USA)	
	8:12053	DOE/RA/50328—T1
FG07-80RA50353	Nebraska Alcohol Fuels Corp., Lincoln (USA)	
	8:12055	DOE/RA/50353—T1-Vol.2
FG07-81ID12274	Singmaster and Breyer, New York (USA)	
	8:12048	DOE/ID/12274—T1-Vol.6
FG07-81ID12325	Colorado State Univ., Fort Collins (USA)	
	8:11972	DOE/ID/12325—4
FG07-81ID12332	INCELL Corp., Milwaukee, WI (USA)	
	8:11973	DOE/ID/12332—T1
FG07-81RA50298	Sverdrup/Sverdrup Technology, Inc., Tullahoma, TN (USA)	
	8:11974	DOE/RA/50298—T1-Bk.2
	CfC, Inc., Dayton, OH (USA)	
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	Information Resources, Inc., Washington, DC (USA)	
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	Sverdrup Technology, Inc., Tullahoma, TN (USA)	
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FG07-81RA50338	Badger America, Inc., Tampa, FL	
	8:12016	DOE/RA/50338—1-Attach.B-Vol.3
	Tate and Lyle Technical Services Ltd., Coral Gables, FL (USA)	
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FG21-78ET11430	California Inst. of Tech., Pasadena (USA)	
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FG22-81PC40783	Pennsylvania State Univ., University Park (USA). Dept. of Chemistry	
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FG22-81PC40796	Naples Univ. (Italy)	
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FG22-81PC40799	Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)	
	8:11632	DOE/PC/40799—T4

Contract No.	Abstract No.	Report No.
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FG22-81PC40800	Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering	
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FG22-81PC40807	Southern Illinois Univ., Carbondale (USA)	
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FG22-81PC40809	Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry	
	8:12750	DOE/PC/40809—T4
FG22-81PC40812	Western Kentucky Univ., Bowling Green (USA). Dept. of Chemistry	
	8:11637	DOE/PC/40812—T5
FG22-81PC41766	Duquesne Univ., Pittsburgh, PA (USA)	
	8:12751	DOE/PC/41766—T1
FG22-82PC50783	Battelle Columbus Labs., OH (USA)	
	8:11643	DOE/PC/50783—1
FG22-82PC50798	Colorado Univ., Boulder (USA). Dept. of Chemical Engineering	
	8:11644	DOE/PC/50798—1
FG22-82PC50816	Brigham Young Univ., Provo, UT (USA)	
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NAS-7-100-955909	Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.	
	8:12050	DOE/JPL/955909—82/8
NAS-7-100-956205	Spectrolab, Inc., Sylmar, CA (USA)	
	8:12049	DOE/JPL—956205-82/2
W-31-109-ENG-38	Argonne National Lab., IL (USA)	
	8:11681	ANL/LRP-TM—22
	SCS Engineers, Inc., Covington, KY (USA)	
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	8:12861	
	Argonne National Lab., IL (USA)	
	8:13178	CONF-801039—13
	8:13293	ANL—81-79
	8:13319	ANL/NDM—68
	8:13320	ANL/NDM—73
	8:13348	ANL/NDM—64
	8:13537	ANL—82-73
W-7405-ENG-26	Oak Ridge National Lab., TN (USA)	
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	IIT Research Inst., Chicago, IL (USA)	
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	Oak Ridge National Lab., TN (USA)	
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	Oak Ridge Associated Universities, Inc., TN (USA)	
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	Oak Ridge National Lab., TN (USA)	
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	Oak Ridge Gaseous Diffusion Plant, TN (USA)	
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	8:11946	CONF-8111132—1

Contract No.	Abstract No.	Report No.
	Oak Ridge Y-12 Plant, TN (USA)	
	8:12041	CONF-821213—2
	Oak Ridge National Lab., TN (USA)	
	8:12065	ORNL—5894
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	8:12474	K/TD—409
	Oak Ridge National Lab., TN (USA)	
	8:12491	CONF-821220—1
	8:12508	ORNL—5918
	8:12556	CONF-820112—11
	8:12557	CONF-821213—3
	8:12558	CONF-821217—1
	8:12559	CONF-821217—2
	8:12563	ORNL/CON—69
	8:12614	CONF-821101—16
	8:12648	ORNL/TM—8524
	8:12660	CONF-811150—10-Draft
	Oak Ridge Y-12 Plant, TN (USA)	
	8:12692	Y/DV—252
	8:12702	
	8:12703	
	Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)	
	8:12720	Y/Sub—80-7733/1-01
	Oak Ridge National Lab., TN (USA)	
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	8:12840	CONF-821216—3
	8:12841	CONF-821216—4
	8:12842	CONF-821216—6
	8:12843	CONF-821216—8
	8:12844	CONF-821216—9
	8:12855	ORNL/CSD/TM—149
	Oak Ridge Y-12 Plant, TN (USA)	
	8:12856	Y—2277
	8:12857	Y/DX—111
	8:12866	
	Oak Ridge National Lab., TN (USA)	
	8:12875	ORNL-tr—4934([nd]).
	Oak Ridge Y-12 Plant, TN (USA)	
	8:12888	Y/IA—156
	Oak Ridge National Lab., TN (USA)	
	8:12930	ORNL/CSD/TM—191
	8:13007	ORNL/TM—8589
	8:13020	CONF-821136—6
	8:13034	Environmental Conservation 8 NO. 4. 285-297 (Win 1981).
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	8:13052	CONF-8210105—1
	8:13057	Australian Journal of Ecology 6 149-164 (1981).
	8:13062	ORNL/TM—8374
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	8:13077	Environmental Biology of Fishes 6 NO. 3/4. 315-332 (1981).
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	8:13084	EPA—570/9-82-003

Contract No.	Abstract No.	Report No.
	8:13095	
	8:13102	CONF-821218—1
	8:13131	ORNL/TM—8533
	8:13169	Biochimica et Biophysica Acta 697 229-234 (1982).
	8:13173	
	8:13197	ORNL—5695/Pt.1
	8:13444	ORNL/TM—8106
	8:13445	ORNL/TM—8107
	Grumman Aerospace Corp., Bethpage, NY (USA)	
	8:13465	CONF-821103—49
	Oak Ridge National Lab., TN (USA)	
	8:13479	GA-A—16885
	Hughes Aircraft Co., Torrance, CA (USA). Electron Dynamics Div.	
	8:13489	ORNL/Sub—79/33200/10
	Oak Ridge National Lab., TN (USA)	
	8:13490	ORNL/TM—7855
	8:13491	ORNL/TM—8474
	8:13492	ORNL/TM—8504
	8:13493	ORNL/TM—8515
	8:13494	ORNL/TM—8593
	Oak Ridge Y-12 Plant, TN (USA)	
	8:13499	Y/DX—103
W-7405-ENG-36	**Los Alamos National Lab., NM (USA)**	
	8:11923	LA—9329-MS
	8:11927	LA-UR—82-3483
	8:11939	LA—9544-M
	8:12063	LA-UR—82-3566
	New Mexico Univ., Albuquerque (USA). Dept. of Economics	
	8:12160	LA-UR—82-870
	Los Alamos National Lab., NM (USA)	
	8:12161	LA-UR—82-3525
	8:12162	LA-UR—82-3634
	8:12245	LA-UR—82-3584
	8:12246	LA-UR—82-3682
	8:12322	LA-UR—82-3279
	8:12352	NUREG/CR—2966
	8:12684	LA-UR—82-3563
	8:12723	LA—9559-MS
	8:12724	LA—9564-MS
	8:12824	LA-UR—82-3557
	8:12850	LA—9466-MS
	8:12851	LALP—82-34
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	8:12971	LA-UR—82-3330
	8:13022	LA—9601-MS
	8:13028	LA-UR—82-3489
	8:13042	LA-UR—82-3488
	8:13043	LA-UR—82-3681
	8:13065	LA-UR—82-3500
	8:13074	LA—9445-PNTX-B
	8:13136	LA—9539-MS
	8:13152	LA-UR—82-3658
	8:13218	LA-UR—82-3641
	8:13230	LA-UR—82-3578
	8:13231	LA-UR—82-3596
	8:13264	LA—9566-MS
	8:13334	LA—9604-MS
	8:13407	LA-UR—82-3338
	8:13437	LA-UR—82-3289
	8:13438	LA-UR—82-3290
	8:13439	LA-UR—82-3317
	8:13440	LA-UR—82-3323
	8:13441	LA-UR—82-3324
	8:13442	LA-UR—82-3380
	8:13485	LA-UR—82-3328
	8:13550	LA-UR—82-3322
	8:13551	LA-UR—82-3334
	8:13552	LA-UR—82-3398
	8:13553	LA-UR—82-3550
	8:13554	LA-UR—82-3657
W-7405-ENG-48	**Lawrence Livermore National Lab., CA (USA)**	
	8:11663	UCRL—52000-82-11
	8:11821	UCRL—53320
	8:11854	UCRL—88254
	8:11913	UCRL—53338
	8:11942	UCRL—87250
	8:12202	UCRL—87802-Rev.1
	8:12216	Geological Society of America, Special Paper NO. 189. 375-386 (1982).
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	8:12527	UCID—19412-Vol.2
	8:12528	UCID—19412-Vol.3
	8:12529	UCID—19412-Vol.4
	8:12530	UCID—19412-Vol.5
	8:12643	UCRL—88233-Rev.1
	8:12647	UCRL—88233
	8:12690	UCID—19605
	8:12691	UCRL—88400
	8:12701	Metal Science 15 541-548 (Nov 1981).
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	McDonnell Douglas Research Labs., St. Louis, MO (USA)	
	8:12726	UCRL—15512
	Lawrence Livermore National Lab., CA (USA)	
	8:12727	UCRL—53298
	8:12728	UCRL—87546-Rev.1
	8:12742	UCRL—88334
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	8:12794	Journal of Catalysis 77 NO. 1. 94-103 (Sep 1982).
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	8:12854	NUREG/CR—3006
	8:12887	UCRL—88314
	8:12908	UCID—19639
	8:12909	UCRL—87760
	8:12934	UCRL—87768
	Pacific Northwest Lab., Richland, WA (USA)	
	8:12982	PNL-SA—9950(Oct 1981).
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	Lawrence Livermore National Lab., CA (USA)	
	8:12994	UCRL—86222
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	8:13012	UCID—19640
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	8:13016	UCRL—88474
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	8:13112	Carcinogenesis (New York) 3 NO. 4. 397-402 (1982).
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	8:13196	UCRL—53345
	8:13198	
	8:13199	Geological Society of America, Special Paper NO. 189. 3-23 (1982).
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Contract No.	Abstract No.	Report No.
	8:13205	Geological Society of America, Special Paper NO. 189. 273-293 (1982).
	8:13212	NUREG/CR—3102
	Department of Energy, Mines and Resources, Ottawa, Ontario (Canada). Canada Centre for Mineral and Energy Technology	
	8:13221	UCRL—87217
	Lawrence Livermore National Lab., CA (USA)	
	8:13343	UCRL—53364
	8:13378	UCID—19604
	8:13379	UCID—19616
	8:13409	UCRL—88315
	8:13418	Numerical Heat Transfer 2 519-520 (1979).
	8:13452	UCRL—87491
	8:13468	CONF-821212—Suppl.
	California Univ., Davis (USA). Dept. of Mechanical Engineering	
	8:13496	UCRL—15367-Pt.3
	Lawrence Livermore National Lab., CA (USA)	
	8:13497	UCRL—87122
	8:13498	UCRL—87735-Rev.1
	8:13536	UCRL—88465
	8:13567	UCID—19637
	8:13568	UCRL—88359
	8:13569	UCRL—88475
W-7405-ENG-82	**Ames Lab., IA (USA)**	
	8:11652	IS-T—1006
	8:11677	IS-T—989
	8:11678	IS-T—990
	8:11757	IS-T—1022
	8:11982	IS-T—1011
	8:12061	IS-T—1020
	8:12062	IS-T—1045
	8:12402	IS-M—384
	Iowa State Univ. of Science and Technology, Ames (USA). Rare-Earth Information Center	
	8:12673	IS-RIC-PR—3
	Ames Lab., IA (USA)	
	8:12674	IS-T—912
	8:12675	IS-T—993
	8:12676	IS-T—1000
	8:12677	IS-T—1026
	8:12678	IS-T—1027
	8:12679	IS-T—1028
	8:12680	IS-T—1037
	8:12681	IS-T—1040
	8:12682	IS-T—1049
	8:12711	IS-T—951
	8:12712	IS-T—998
	8:12713	IS-T—1030
	8:12714	IS-T—1039
	8:12737	IS-T—963
	8:12738	IS-T—1018
	8:12739	IS-T—1019
	8:12754	IS-T—965
	8:12755	IS-T—988
	8:12756	IS-T—994
	8:12757	IS-T—1023
	8:12758	IS-T—1048
	8:12783	IS-M—388
	8:12784	IS-M—389
	8:12785	IS-T—959
	8:12786	IS-T—964
	8:12787	IS-T—1007
	8:12788	IS-T—1031
	8:12789	IS-T—1034
	8:12790	IS-T—1035
	8:12791	IS-T—1036
	8:12807	IS-T—1032
	8:12815	IS-T—1009
	8:12823	IS-T—1004
	8:12880	IS-M—390
	8:13263	IS-T—983
	8:13278	IS-T—1017
	8:13312	IS-T—1012
	8:13403	IS-T—1025
	8:13417	IS-T—1014
W-7405-ENG-92	**Battelle Columbus Labs., OH (USA)**	
	8:12705	BMI—2101

REPORT NUMBER INDEX

The numbers assigned to all reports cited in the publication appear in the first column of the index. Cross reference information and/or availability are included as appropriate. Abbreviations used in the availability column are elaborated at the end of the index. To expedite the filling of orders for reports from NTIS and TIC, an order number in the form, DE82000001, appears in column 3. Requesters are urged to use this order number where provided. In column 4, one or more DOE distribution categories are indicated, e.g. , STD-10, MN-25. STD indicates distribution was made in full-size copy; MN indicates microcopy distribution. These category numbers are included to assist DOE librarians in responding to requests for reports in their collections. The UC (Unclassified Distribution Categories) are defined in DOE/TIC-4500, available from TIC. The citation numbers are given in column 5. NOTE: DOE attempts to disseminate its information as broadly as possible. Even though a report may contain some degree of illegibility, it is believed that the report may still make a contribution. The presence of a 1, 2, or 3 following NTIS in the availability column denotes the extent to which a report may be illegible and the form in which it is available: 1 = 1 to 5% illegibility, available PC and MF; 2 = 6 to 10% illegibility, available MF only; 3 = 11% or more illegibility, available PC only.

Report No.	*Availability*	*Order No.*	*Distribution Category*	*Abstract No.*
AAEC/E-				
539	NTIS (US Sales Only), PC A02/MF A01	DE82703329	MN -80	8:12337
ACNS-				
1	*See* INFO-0054	DE82703384	MN -2	8:12326
2	*See* INFO-0055	DE82703385	MN -2	8:12327
3	*See* INFO-0056	DE82703344	MN -80	8:12400
AD-A-				
118268/ 2	NTIS, PC A02/MF A01			8:12023
118363/ 1	NTIS, PC A06/MF A01			8:12454
118439/ 9	NTIS, PC A07/MF A01			8:12836
118898/ 6	NTIS, PC A06/MF A01			8:12551
119030/ 5	NTIS, PC A07/MF A01			8:12891
119102/ 2	NTIS, PC A06/MF A01			8:12552
119150/ 1	NTIS, PC A02/MF A01			8:12455
119243/ 4	NTIS, PC A05/MF A01			8:12381
119291/ 3	NTIS, PC A04/MF A01			8:12892
119297/ 0	NTIS, PC A06/MF A01			8:12456
119356/ 4	NTIS, PC A05/MF A01			8:12837
119381/ 2	NTIS, PC A11/MF A01			8:12457
119389/ 5	NTIS, PC A04/MF A01			8:12261
AERE-R-				
10409	NTIS (US Sales Only), PC A03/MF A01	DE82703372	MN -37	8:12876
10516	NTIS (US Sales Only), PC A02/MF A01	DE82703059	MN -70	8:11863
ANL-				
81-79	NTIS, PC A13/MF A01	DE82021147	STD -34	8:13293
82-73	NTIS, PC A02/MF A01	DE83004400	STD -32	8:13537
ANL/CNSV-TM-				
103	NTIS, PC A06/MF A01	DE83003631	MN -11	8:11959
ANL/LRP-TM-				
22	NTIS MF A01	DE83002715	MN -90i	8:11681
ANL/NDM-				
64	NTIS, PC A03/MF A01	DE83004437	MN -34C	8:13348
68	NTIS, PC A02/MF A01	DE83004436	MN -34C	8:13319
73	NTIS, PC A02/MF A01	DE83004435	MN -34C	8:13320
ARL/PSU/TM-				
82-76	*See* AD-A-118439/9			8:12836
ASA-I-				
38/ 79	NTIS (US Sales Only), PC A04/MF A01	DE82750921	MN -98	8:12479
ASCOT-				
82-5	*See* PNL-4406	DE83004100	MN -11	8:13023
ATS-TUH-				
1081	NTIS (US Sales Only), PC A06/MF A01	DE82750944	MN -34D	8:13373
BARC-				
1129	NTIS (US Sales Only), PC A09/MF A01	DE82703332	MN -80	8:12338
1133	NTIS (US Sales Only), PC A03/MF A01	DE82703374	MN -37	8:12730
BDX-				
613-2848	NTIS, PC A02/MF A01	DE83004945	MN -25	8:12722
613-2854	NTIS, PC A03/MF A01	DE83004098	MN -38	8:13005
613-2865	NTIS, PC A02/MF A01	DE83004942	MN -38	8:12747
613-2874	NTIS, PC A02/MF A01	DE83004941	MN -38	8:12729
613-2876	NTIS, PC A02/MF A01	DE83004126	MN -38	8:13374
613-2886	NTIS, PC A03/MF A01; 1	DE83005327	MN -38	8:13538
BLG-				
549	NTIS (US Sales Only), PC A03/MF A01	DE83900365	MN -94c	8:11954
552	NTIS (US Sales Only), PC A09/MF A01	DE82703346	MN -78	8:12299
BM-RI-				
8451	Bureau of Mines, Washington, DC		MN -95f	8:13215
BMFT-				
150-423-Pt.1	NTIS (US Sales Only), MF A01	DE83900588	MN -32	8:12877

Report No.	Availability	Order No.	Distribution Category	Abstract No.
BMFT-FB-RS-				
179-Pt.2	NTIS (US Sales Only), MF A01	DE82904405	MN -78	8:12383
BMFT-FB-T-				
094	NTIS (US Sales Only), PC A03/MF A01	DE82750918	MN -90f	8:12267
BMFT-RS-				
150-365-Pt.1	NTIS (US Sales Only), PC A03/MF A01	DE83900600	MN -80	8:12384
150-365-Pt.2	NTIS (US Sales Only), PC A07/MF A01	DE83900599	MN -80	8:12385
150-365-Pt.3	NTIS (US Sales Only), PC A07/MF A01	DE83900598	MN -80	8:12386
BMI-				
2101	NTIS, PC A02/MF A01	DE83005038	MN -25	8:12705
BNL-				
30030	NTIS MF A01	DE81031968	MN -25	8:12659
30628	NTIS, PC A02/MF A01	DE83003217	MN -48	8:13176
31364	NTIS, PC A02/MF A01	DE83005121	MN -97c	8:12497
32086	NTIS, PC A02/MF A01	DE83002818	MN -21	8:12864
32087	NTIS, PC A02/MF A01	DE83002840	MN -34	8:12937
32132	NTIS, PC A03/MF A01	DE83003965	MN -4	8:12748
32143	NTIS, PC A02/MF A01	DE83002827	MN -34D	8:13283
32147	NTIS, PC A02/MF A01	DE83003950	MN -34D	8:13284
32167	NTIS, PC A02/MF A01	DE83003961	MN -28	8:12938
32168	NTIS, PC A02/MF A01	DE83003957	MN -28	8:12899
32169	NTIS, PC A02/MF A01	DE83003956	MN -28	8:12910
32172	NTIS, PC A02/MF A01	DE83003960	MN -94cc	8:12520
32173	NTIS, PC A02/MF A01	DE83004634	MN -37	8:12911
32174	NTIS, PC A02/MF A01	DE83004630	MN -32	8:13117
32175	NTIS, PC A02/MF A01	DE83004631	MN -32	8:12939
32178	NTIS, PC A02/MF A01	DE83003958	MN -11	8:13018
32188	NTIS MF A01	DE83005147	MN -34D	8:13267
32190	NTIS, PC A02/MF A01	DE83003959	MN -94ca	8:12458
32208	NTIS, PC A02/MF A01	DE83004603	MN -37	8:12943
32210	NTIS, PC A02/MF A01	DE83003929	MN -25	8:13216
32211	NTIS, PC A02/MF A01	DE83004602	MN -4	8:12818
32212	NTIS, PC A03/MF A01	DE83003938	MN -34C	8:12749
32230	NTIS, PC A02/MF A01	DE83003955	MN -34D	8:13285
32237	NTIS, PC A02/MF A01	DE83004590	MN -23	8:12912
32239	NTIS, PC A02/MF A01	DE83004601	MN -28	8:12894
32247	NTIS, PC A03/MF A01	DE83004594	MN -34D	8:13253
32255	NTIS, PC A02/MF A01	DE83004604	MN -48	8:13059
32263	NTIS MF A01	DE83003945	MN -34D	8:13268
32264	NTIS MF A01	DE83003939	MN -34D	8:13254
32275	NTIS, PC A04/MF A01	DE83004591	MN -41	8:13100
32297	NTIS, PC A02/MF A01	DE83004582	MN -48	8:13129
32304	NTIS, PC A02/MF A01	DE83004599	MN -34	8:12913
51432-Rev.A	NTIS, PC A04/MF A01	DE83002247	MN -32	8:13539
51606	NTIS, PC A04/MF A01	DE83005456	MN -11	8:13019
BNL-NCS-				
28878	NTIS, PC A02/MF A01	DE83005676	MN -34C	8:13321
BNL-NUREG-				
51449-Vol.2-No.1	*See* NUREG/CR-2317-Vol.2-No.1	DE83002110	MN -70	8:12686
BROWN/HET-				
480	NTIS, MF A01; 2	DE83004528	MN -34D	8:13247
C-				
598	*See* AD-A-118268/2			8:12023
656	*See* AD-A-118363/1			8:12454
CAPE-				
2770	EM	DE83001837		8:12128
2771	EM	DE83001809		8:12127
2772	EM	DE83002034		8:12174
2775	EM	DE83004987		8:13003
2776	EM	DE83004988		8:12935
2777	EM	DE83004989		8:13002
2778	EM	DE83004990		8:12936
CBPF-NF-				
035/ 81	NTIS (US Sales Only), PC A03/MF A01	DE82703357	MN -37	8:12944
CEA-CONF-				
6157	NTIS (US Sales Only), PC A03/MF A01	DE82703337	MN -80	8:12349
6241	NTIS (US Sales Only), PC A02/MF A01	DE82703060	MN -70	8:11864
6259	NTIS (US Sales Only), PC A02/MF A01	DE82703058	MN -70	8:11865
CEA-N-				
2254	NTIS (US Sales Only), PC A12/MF A01	DE82703375	MN -37	8:12838
2259	NTIS (US Sales Only), PC A09/MF A01	DE82703347	MN -78	8:12300
2262	NTIS (US Sales Only), PC A04/MF A01	DE82703389	MN -32	8:13540
2268	NTIS (US Sales Only), PC A13/MF A01	DE82703391	MN -32	8:13541
2275	NTIS (US Sales Only), PC A11/MF A01	DE82703063	MN -32	8:13542
CEND-				
399	*See* DOE/ET/34013-5	DE83004278	STD -78	8:12334
CERN-				
82-05	NTIS (US Sales Only), PC A03/MF A01	DE82703315	MN -28	8:12914
82-06	NTIS (US Sales Only), PC A02/MF A01	DE82703359	MN -37	8:12945
82-07	NTIS (US Sales Only), PC A03/MF A01	DE82703376	MN -37	8:13543
CNEN-DR-				
87/ 80	NTIS (US Sales Only), PC A03/MF A01	DE82703380	MN -2	8:12323
89/ 80	NTIS (US Sales Only), PC A03/MF A01	DE82703381	MN -2	8:12324
102/ 81	NTIS (US Sales Only), PC A06/MF A01	DE82703392	MN -32	8:12301

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CNEN-RT/PROT-(81) 5	NTIS (US Sales Only), MF A01	DE82903130	MN -11	8:13050
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CONF-7711157-1	(24. Holm conference on electrical contacts, Chicago, IL, USA, 11 Nov 1977) NTIS, PC A02/MF A01	DE83005226	MN -20b	8:13470
CONF-780666-	(Conference on fundamentals of tribology, Cambridge, MA, USA, 19-23 Jun 1978) Cambridge, Massachusetts; The MIT Press (1980).			8:12835
CONF-780683-3	(Passenger car meeting, Troy, MI, USA, 5-9 Jun 1978) Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096			8:11614
CONF-7807110-	(5. national conference on effects of energy constraints on the transportation systems, Schenectady, NY, USA, 31 Jul-4 Aug 1978) NTIS, PC A19/MF A01	DE82022190	STD -96	8:12582
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CONF-790284-	(Symposium on recent trends in hydrogeology, Berkeley, CA, USA, 8-9 Feb 1979) Geol. Soc. Am., Spec. Pap., No. 189, 397-405(1982)			8:11740
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	Geol. Soc. Am., Spec. Pap., No. 189, 407-426(1982)			8:12238
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	Geological Society of America, Inc., P.O. Box 9140, 3300 Penrose Place, Boulder, CO 80301			8:13198
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CONF-7905159-	(10. conference on problem of charged particle beams using for studying substance composition and properties, Moscow, USSR, 28-30 May 1979)			
Pt.2	*See* INIS-SU-115	DE83780082	MN -34A	8:13238
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CONF-7908174-	(6. conference of Czechoslovak physicists, Ostrava, Czechoslovakia, 27-31 Aug 1979)			
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Pt.1Vol.2	*See* INIS-mf-7220	DE83780084	MN -34A	8:13223
Pt.2	*See* INIS-mf-7221	DE83780081	MN -34D	8:13224
CONF-8005231-	(6. annual Austrian Study Group conference meeting for radioactivity measurements in the Danube, Vienna, Austria, 1 May 1980) *See* INIS-mf-7224	DE83780197	MN -11	8:13087
CONF-800645-	(Special session on nuclear waste disposal, Stockholm, Sweden, 23-27 Jun 1980)			
3	*See* PNL-SA-7982	DE83002703	MN -94e	8:12450
CONF-800802-	(89. annual meeting of the American Institute of Chemical Engineers, Portland, OR, USA, 17-20 Aug 1980)			
29	*See* PNL-SA-8281	DE83002737	MN -11	8:13030
CONF-800804-	(ASME century 2 emerging technology conference, San Francisco, CA, USA, 10-22 Aug 1980)			
13	*See* UCRL-83045	DE83005510	MN -78	8:12420
CONF-800805-	(Joint automatic control conference, San Francisco, CA, USA, 13-15 Aug 1980)			
3	*See* UCRL-83592	DE83005508	MN -38	8:12793
4	*See* Y/DX-103	DE83005509	MN -38	8:13499
5	*See* Y/DX-111	DE83005511	MN -38	8:12857
CONF-800944-	(7. symposium on microdosimetry, Oxford, UK, 8-12 Sep 1980)			
13	*See* PNL-SA-8304	DE83002704	MN -48	8:13392
CONF-800973-	(11. biomass thermochemical conversion contractors meeting, Richland, WA, USA, 23-24 Sep 1980)			
5-Rev.3	*See* PNL-SA-7939-Rev.3	DE83002736	MN -61a	8:12067

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CONF-8009170-	(American Public Power Association energy management and communications workshop, Myrtle Beach, SC, USA, 30 Sep-2 Oct 1980)			
1	American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC		MN -13	8:12470
5	American Public Power Association, 2600 Virginia Ave. NW, Washington, DC		MN -96	8:12649
CONF-8009198-	(5. national Soviet conference on neutron physics, Kiev, Ukrainian SSR, 15-19 Sep 1980)			
Pt.4	*See* INIS-SU-104	DE83780217	MN -20	8:13435
CONF-8009281-	(2. working meeting on radiation interaction, Leipzig, F.R. Germany, 22-26 Sep 1980)			
Pt.1	*See* ZfI-Mitt-43a	DE83780129	MN -34A	8:13242
Pt.2	*See* ZfI-Mitt-43b	DE83780130	MN -34A	8:12743
CONF-8009294-	(National biochemical days conference, Piestany, Czechoslovakia, 16-19 Sep 1980)			
Abstr.	*See* INIS-mf-7218	DE83780218	MN -4	8:13104
CONF-8009299-	(Systematic comprehensive evaluation and total effectiveness of repositories workshop, Houston, TX, USA, 29 Sep-3 Oct 1980)			
1	*See* PNL-SA-8409	DE83002755	MN -70	8:13558
CONF-801030-	(4. international symposium on alcohol fuels technology, Sao Paulo, Brazil, 5-8 Oct 1980)			
Vol.3	NTIS (US Sales Only), PC A15/MF A01		MN -61a	8:12024
CONF-801039-	(20. annual Hanford Life Sciences symposium, Richland, WA, USA, 19-23 Oct 1980)			
13	NTIS, PC A02/MF A01	DE83025791	MN -11	8:13178
CONF-8010211-	(American Public Power Association accounting and finance workshop, San Antonio, TX, USA, 7 Oct 1980)			
1	American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC		MN -97	8:12498
CONF-8010310-	(2. technical contractors' conference on peat, Bethesda, MD, USA, 16-17 Oct 1980)			
	See DOE/ET/10159-T18	DE83000831	MN -89	8:11600
CONF-8010312-	(VOREM 80 conference, Brno, Czechoslovakia, 30-31 Oct 1980)			
	See INIS-mf-7501	DE83780119	MN -4	8:12753
CONF-801107-	(ANS international conference, Washington, DC, USA, 17-21 Nov 1980)			
	Trans. Am. Nucl. Soc., 35: 106-107(1980)			8:11860
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	Trans. Am. Nucl. Soc., 35: 108-109(1980)			8:11862
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	Trans. Am. Nucl. Soc., 35: 173(1980)			8:12360
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	Trans. Am. Nucl. Soc., 35: 562-564(1980)			8:12444
	Trans. Am. Nucl. Soc., 35: 607-608(1980)			8:12445
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CONF-8011101-	(American Public Power Association legal seminar, Boston, MA, USA, 10-12 Nov 1980)			
1	American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC		MN -97e	8:11995
2	American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC		MN -13	8:12499
3	American Public Power Association, 2600 Virginia Ave., N.W., Washington, DC		MN -98E	8:12500
4	American Public Power Association, 2600 Virginia Ave., N.W., Washington, DC		MN -13	8:12501
5	American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC		MN -97	8:12502
6	American Public Power Association, 2600 Virginia Ave. N.W., Washington, DC		MN -98E	8:12503
7	American Public Power Assoc., 2600 Virginia Ave., NW, Washington, DC		MN -98G	8:12484
8	American Public Power Association, 2600 Virginia Avenue, Washington, DC		MN -95e	8:12626
CONF-8103153-	(Environmental Mutagen Society annual meeting, San Diego, CA, USA, 7 Mar 1981)			
1	NTIS, PC A02/MF A01	DE83004581	MN -48	8:13179

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CONF-810417-	(90. AICHE national meeting, Houston, TX, USA, 5-9 Apr 1981)			
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	AIChE Symp. Ser., 78: No. 212, 1-27(1982)			8:11800
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	AIChE Symp. Ser., 78: No. 212, 42-57(1982)			8:11802
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	AIChE Symp. Ser., 78: No. 212, 105-112(1982)			8:11805
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	AIChE Symp. Ser., 78: No. 212, 97-104(1982)			8:12772
	AIChE Symp. Ser., 78: No. 212, 86-96(1982)			8:12801
CONF-810606-	(American Nuclear Society's annual meeting, Miami Beach, FL, USA, 7-12 Jun 1981)			
18	*See* BNL-NCS-28878	DE83005676	MN -34C	8:13321
CONF-810650-	(International seminar on chemistry and process engineering for high-level waste solidification, Julich, F.R. Germany, 1-5 Jun 1981)			
Vol.1	*See* Juel-Conf-42-Vol.2	DE82905800	MN -70	8:11888
CONF-810658-	(11. biennial lignite symposium, San Antonio, TX, USA, 15 Jun 1981)			
Vol.1	*See* GFETC/IC-82/1	DE82015926	STD -90	8:11718
CONF-8106182-	(8. DOE workshop on personnel neutron dosimetry, Louisville, KY, USA, 18-19 Jun 1981)			
	See PNL-SA-9950	DE83003653	MN -41	8:13393
CONF-810835-	(1981 cryogenic engineering conference, San Diego, CA, USA, 10-14 Aug 1981)			
30	*See* BNL-30030	DE81031968	MN -25	8:12659
CONF-8108141-	(8. annual international conference on coal gasification, liquefaction, and conversion to electricity, Pittsburgh, PA, USA, 4-6 Aug 1981)			
	NTIS, PC A21/MF A01	DE82905463	MN -90	8:11584
CONF-8109120-	(Nuclear International Jura '81, Palma de Mallorca, Spain, 27 Sep-1 Oct 1981)			
24	*See* INIS-mf-7038	DE82780782	MN -2	8:12401
CONF-8110111-	(International conference on radiation hazards in mining: control, measurement, and medical aspects, Golden, CO, USA, 4-9 Oct 1981)			
	New York, NY; American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. (1981).			8:13170
CONF-8110248-	(7. North American meeting of the Catalysis Society, Boston, MA, USA, 11-15 Oct 1981)			
Absts.	Engelhard Corp., Engelhard Industries Div., Research Dept., Edison, NJ		MN -4	8:12774
CONF-811108-	(Annual meeting of the Institute of Chemical Engineers, New Orleans, LA, USA, 8-12 Nov 1981)			
21-Draft	NTIS, PC A02/MF A01	DE83003411	MN -86	8:11847
CONF-811148-	(Conference on IGT fuel cells technology status and applications, Chicago, IL, USA, 16-18 Nov 1981)			
	Institute of Gas Technology, 3424 South State St., Chicago, IL, $40.00			8:12531
CONF-811150-	(Yamada conference on point defects and defect interactions in metals, Kyoto, Japan, 16-20 Nov 1981)			
10-Draft	NTIS, PC A02/MF A01	DE83003504	MN -25	8:12660
CONF-811175-	(WMO technical conference on meteorology and energy, Mexico City, Mexico, 3-7 Nov 1981)			
	NTIS (US Sales Only), PC A08/MF A01	DE83900306	MN -98D	8:11999
CONF-8111118-	(Fluid-structure interactions in turbomachinery conference, Washington, DC, USA, 15-20 Nov 1981)			
1	*See* CEA-CONF-6157	DE82703337	MN -80	8:12349
CONF-8111119-	(IAEA seminar on safety review and inspection of nuclear power plants, Vienna, Austria, 23-27 Nov 1981)			
1	*See* INFO-0052	DE82703383	MN -2	8:12399
CONF-8111132-	(Illuminating Engineering Society aviation lighting seminar, Williamsburg, VA, USA, 9-13 Nov 1981)			
1	NTIS, PC A02/MF A01	DE83003436	MN -23	8:11946
CONF-811250-	(Conference on geothermal energy: the institutional maze and its changing structure, Newport Beach, CA, USA, 1-2 Dec 1981)			
	Geothermal Resources Council, P.O. Box 98, Davis, CA 95617		MN -66h	8:12217
CONF-820112-	(Semiannual meeting of the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Houston, TX, USA, 24-28 Jan 1982)			
11	NTIS, PC A02/MF A01	DE82017546	MN -95d	8:12556
CONF-820307-	(Topical meeting on engineering for nuclear plant construction, operation, and maintenance, Charleston, SC, USA, 28-31 Mar 1982)			
	Trans. Am. Nucl. Soc., Suppl., 41: 36-37(1982)			8:12440
CONF-820324-	(Biomass-to-methanol specialists workshop, Durango, CO, USA, 3-5 Mar 1982)			
	See SERI/CP-234-1590	DE82022032	MN -61a	8:11983

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CONF-8203103-	(4. annual symposium on industrial coal utilization, Cincinnati, OH, USA, 31 Mar-2 Apr 1982)			
	NTIS, PC A09/MF A01	DE83004459	MN -98A	8:11780
CONF-8203107-	(7. international NEA/Seabed working group meeting, La Jolla, CA, USA, 15-19 Mar 1982)			
	See SAND-82-0460	DE83004765	STD -70	8:11907
CONF-820419-	(Enhanced oil recovery symposium, Tulsa, OK, USA, 4-7 Apr 1982)			
Suppl.	NTIS, PC A03/MF A01	DE83004568	MN -92a	8:11792
CONF-820420-	(International ENS/ANS conference on nuclear energy with emphasis on fuel cycles, Brussels, Belgium, 26-30 Apr 1982)			
10	*See* CEA-CONF-6259	DE82703058	MN -70	8:11865
CONF-820424-	(ANS topical meeting on treatment and handling of radioactive wastes, Richland, WA, USA, 19-22 Apr 1982)			
34	*See* CEA-CONF-6241	DE82703060	MN -70	8:11864
CONF-820453-	(5. technical conference on peat, Bethesda, MD, USA, 27-29 Apr 1982)			
	See DOE/ET/10159-T25	DE83002171	MN -90	8:11579
CONF-820470-	(Nuetron-antineutron oscillation workshop, Cambridge, MA, USA, 30 Apr-1 May 1982)			
3	*See* DOE/ER/40048-17-P2	DE83004929	MN -34D	8:13275
CONF-820496-	(9. conference of the National Society of Black Physicists scientific lectures, Baton Rouge, LA, USA, 29-30 Apr 1982)			
1	*See* UCRL-87491	DE83005390	MN -34A	8:13452
CONF-820563-	(5. international conference on quantitative NDE in the nuclear industry, San Diego, CA, USA, 10-13 May 1982)			
II	*See* IS-M-390	DE83003790	MN -38	8:12880
CONF-8205100-	(Whiteshell Nuclear Research Establishment symposium, Pinawa, Manitoba, Canada, 21 May 1982)			
2	*See* RHO-BW-SA-198-P	DE83004200	MN -11	8:13091
CONF-8205114-	(American Chemical Society symposium on inorganic chemistry, Bloomington, IN, USA, 16-19 May 1982)			
2	*See* IS-M-388	DE83003793	MN -4	8:12783
CONF-8205116-	(5. international conference on novel results in particle physics, Nashville, TN, USA, 24-26 May 1982)			
	New York, NY; American Institute of Physics (1982).			8:13252
CONF-8205139-	(Metal clusters in chemistry conference, London, UK, 20-21 May 1982)			
1	*See* IS-M-389	DE83003792	MN -4	8:12784
CONF-8205141-	(41. annual technical conference of the Society of Plastics Engineers, Chicago, IL, USA, 2-5 May 1982)			
1	*See* SAND-82-1903C	DE83004013	MN -38	8:12725
CONF-820609-	(American Nuclear Society annual meeting, Los Angeles, CA, USA, 6-11 Jun 1982)			
	Trans. Am. Nucl. Soc., 41: 140-141(Jun 1982)			8:11845
	Trans. Am. Nucl. Soc., 41: 123-125(Jun 1982)			8:11849
	Trans. Am. Nucl. Soc., 41: 143-144(Jun 1982)			8:11855
	Trans. Am. Nucl. Soc., 41: 126(Jun 1982)			8:11856
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	Trans. Am. Nucl. Soc., 41: 127-129(Jun 1982)			8:11858
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	Trans. Am. Nucl. Soc., 41: 630-631(Jun 1982)			8:11914
	Trans. Am. Nucl. Soc., 41: 46(Jun 1982)			8:11931
	Trans. Am. Nucl. Soc., 41: 141-142(Jun 1982)			8:11943
	Trans. Am. Nucl. Soc., 41: 639-640(Jun 1982)			8:11948
	Trans. Am. Nucl. Soc., 41: 426-427(Jun 1982)			8:12369
	Trans. Am. Nucl. Soc., 41: 410-412(Jun 1982)			8:12430
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	Trans. Am. Nucl. Soc., 41: 248(Jun 1982)			8:12432
	Trans. Am. Nucl. Soc., 41: 184-185(Jun 1982)			8:12433
	Trans. Am. Nucl. Soc., 41: 456-457(Jun 1982)			8:12434
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	Trans. Am. Nucl. Soc., 41: 502-504(Jun 1982)			8:12438
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79	*See* PNL-SA-10170	DE83003646	MN -11	8:13045
CONF-820626-	(15. power modulator symposium, Baltimore, MD, USA, 14-16 Jun 1982)			
14	*See* UCRL-87727	DE83004207	MN -38	8:12448

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CONF-820628-	(11. international symposium on effects of radiation on materials, American Society for Testing and Materials, Scottsdale, AZ, USA, 28-30 Jun 1982)			
18	NTIS, PC A02/MF A01	DE83004887	MN -25	8:12661
CONF-820629-	(American section of the International Solar Energy Society conference, Houston, TX, USA, 1-5 Jun 1982)			
1	*See* LA-UR-82-870	DE82012152	MN -59	8:12160
CONF-820633-	(Workshop on containment integrity for nuclear power reactors, Arlington, VA, USA, 7-9 Jun 1982)			
7	*See* IS-M-384	DE83003791	MN -25	8:12402
CONF-820655-	(Health Physics Society annual meeting, Las Vegas, NV, USA, 27 Jun-1 Jul 1982)			
12	*See* DPSPU-82-30-3	DE83004927	MN -11	8:13038
CONF-820685-	(14. biomass thermochemical conversion contractor's meeting, Arlington, VA, USA, 23-24 Jun 1982)			
	See PNL-SA-10646	DE83002004	MN -61a	8:12068
CONF-8206116-	(DPF summer study on elementary particle physics and future facilities, Aspen, CO, USA, 28 Jun-16 Jul 1982)			
14	*See* BNL-32247	DE83004594	MN -34D	8:13253
15	*See* LBL-15225	DE83004270	MN -34D	8:12897
16	*See* BNL-32263	DE83003945	MN -34D	8:13268
17	*See* LBL-15089	DE83003759	MN -28	8:12907
18	*See* BNL-32147	DE83003950	MN -34D	8:13284
CONF-8206117-	(13. international symposium on multiparticle dynamics, Volendam, Netherlands, 6-11 Jun 1982)			
3	*See* DOE/ER/40048-20P2	DE83004923	MN -34D	8:13288
CONF-8206136-	(Conference on physics in collision, Stockholm, Sweden, 2-4 Jun 1982)			
2	*See* SLAC-PUB-2963	DE83004155	MN -34D	8:12932
3	*See* SLAC-PUB-2970	DE83004391	MN -34D	8:13290
4	*See* SLAC-PUB-2976	DE83004481	MN -34D	8:13280
CONF-8206140-	(15. annual meeting of Society for Epidemiological Research, Cincinnati, OH, USA, 17-19 Jun 1982)			
1	*See* LBL-14234	DE83003986	MN -48	8:13138
CONF-8206142-	(2. gyrotron conference, Washington, DC, USA, 21-23 Jun 1982)			
1	*See* GA-A-16784	DE83003213	MN -20a	8:13477
CONF-8206144-	(19. European cyclotron progress meeting, Grenoble, France, 10-11 Jun 1982)			
1	*See* INFN/TC-82/8	DE83900840	MN -28	8:12919
CONF-820713-	(Institute of Nuclear Materials meeting, Washington, DC, USA, 19-21 Jul 1982)			
29	*See* UCRL-87250	DE83004247	MN -15	8:11942
CONF-820718-	(21. international conference on high energy physics, Paris, France, 29 Jul-8 Aug 1982)			
18	*See* FERMILAB-Conf-82/69-EXP	DE83002100	MN -34D	8:13258
22	*See* BNL-32143	DE83002827	MN -34D	8:13283
23	*See* SLAC-PUB-2992	DE83004411	MN -34D	8:13266
24	*See* SLAC-PUB-2986	DE83004417	MN -34D	8:12940
CONF-820753-	(Solar hot water field test technical review meeting, Atlanta, GA, USA, 14-15 Jul 1982)			
	See DOE/CH/10122-7	DE83001147	MN -59	8:12135
CONF-820762-	(5. meeting of the Pacific Northwest working Group on nuclear track registration, Richland, WA, USA, 28 Jul 1982)			
1	*See* HEDL-SA-2790	DE83004073	MN -78	8:12398
CONF-820763-	(5. national symposium on probability and statistics, Sao Paulo, Brazil, 26-30 Jul 1982)			
1	*See* DOE/ER/10841-5	DE83004424	MN -32	8:13414
CONF-820764-	(3. international seminar on thermoluminescence and ESR dating, Elsinore, Denmark, 1 Jul 1982)			
1	*See* BNL-32210	DE83003929	MN -25	8:13216
2	*See* BNL-32211	DE83004602	MN -4	8:12818
CONF-820765-	(12. international symposium on acoustical imaging, London, UK, 19-22 Jul 1982)			
1	*See* PNL-SA-10523	DE83003476	MN -38	8:12881
CONF-820801-	(19. international symposium on combustion, Haifa, Israel, 8-13 Aug 1982)			
14	*See* SAND-82-8657	DE83004128	MN -90e	8:11771
15	*See* DOE/ER/10065-3T	DE83005010	MN -38	8:12645
Exc.	*See* SAND-82-8882	DE83003149	MN -96	8:12832
CONF-820803-	(23. US symposium on rock mechanics, Berkeley, CA, USA, 25-27 Aug 1982)			
16	*See* DOE/ER/10361-3-3A	DE83003764	MN -11	8:13217
CONF-820804-	(3. world congress of nuclear medicine and biology, Paris, France, 29 Aug-2 Sep 1982)			
3	*See* BNL-32297	DE83004582	MN -48	8:13129
4	*See* BNL-30628	DE83003217	MN -48	8:13176
CONF-820833-	(17. DOE nuclear air cleaning conference, Denver, CO, USA, 1 Aug-6 Sep 1982)			
18	*See* PNL-SA-10213	DE83002713	MN -41	8:13046
CONF-820839-	(International conference on X-ray and VUV synchrotron radiation instrumentation, Hamburg, F.R. Germany, 9-13 Aug 1982)			
6	*See* BNL-32304	DE83004599	MN -34	8:12913

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CONF-820872-	(33. meeting of Aeroballistic Range Association, Santa Barbara, CA, USA, 18-20 Aug 1982)			
1	*See* SAND-82-1546	DE83002193	MN -38	8:12882
CONF-820891-	(18. ceramic science conference on advances in materials characterization, Alfred, NY, USA, 16-18 Aug 1982)			
5	*See* DP-MS-82-8	DE83004931	MN -70	8:11878
CONF-8208102-	(TVA fertilizer conference, St. Louis, MO, USA, 18-19 Aug 1982)			
	See TVA/OACD-83/2	DE83900363	MN -13	8:13139
CONF-8208103-	(4. European symposium on anti NN and anti QQ interactions, Santiago de Compostella, Spain, 30 Aug-3 Sep 1982)			
1	*See* BNL-32264	DE83003939	MN -34D	8:13254
CONF-8208104-	(Recent advanced in field theory and statistical mechanics conference, Les Houches, France, 2 Aug-10 Sep 1982)			
1	*See* FERMILAB-CONF-82/67-THY	DE83004065	MN -34D	8:13405
CONF-8208105-	(36. annual meeting of the Association of American Plant Food Control officials, Columbus, OH, USA, 3-4 Aug 1982)			
1	*See* TVA/PUB-83/12	DE83900922	MN -13	8:12746
CONF-8208106-	(4. international conference on photochemical conversion and storage of solar energy, Jerusalem, Israel, 8 Aug-13 Sep 1982)			
1	*See* SERI-TP-233-1697	DE83005105	MN -61	8:12816
CONF-820906-	(16. IEEE photovoltaics specialists conference, San Diego, CA, USA, 28-30 Sep 1982)			
37	*See* DOE/NASA/20485-13	DE83005103	STD -63	8:12015
CONF-820909-	(National meeting of the American Chemical Society, Kansas City, MO, USA, 1 Sep 1982)			
11-Rev.1	*See* UCRL-87546-Rev.1	DE83004287	MN -4	8:12728
12	*See* LA-UR-82-3557	DE83004733	MN -4	8:12824
CONF-820914-	(International conference on nuclear power experience, Vienna, Austria, 13-17 Sep 1982)			
5	*See* BNL-32275	DE83004591	MN -41	8:13100
CONF-820930-	(9. international conference on plasma physics and controlled nulcear fusion research, Baltimore, MD, USA, 1-8 Sep 1982)			
9	*See* KMSF-U-1266	DE82020324	MN -21	8:11944
CONF-820941-	(5. international symposium on high energy spin physics, Upton, NY, USA, 16-22 Sep 1982)			
8	*See* FERMILAB-Conf-82/97-EXP	DE83004392	MN -34D	8:13260
9Summ.	*See* BNL-32168	DE83003957	MN -28	8:12899
10	*See* BNL-32230	DE83003955	MN -34D	8:13285
CONF-820943-	(ANS topical meeting - spent fuel storage, Savannah, GA, USA, 26-29 Sep 1982)			
7	*See* PNL-SA-10649	DE83002738	MN -85	8:11904
CONF-820948-	(12. symposium on fusion technology, Juelich, F.R. Germany, 13-17 Sep 1982)			
6	*See* GA-A-16748	DE83003218	MN -20e	8:13476
CONF-820973-	(International conference on decontamination of nuclear facilities, Niagara Falls, Canada, 19-22 Sep 1982)			
1	*See* PNL-SA-9990		MN -78	8:12418
CONF-820979-	(International conference on nucleus-nucleus collisions, East Lansing, MI, USA, 27 Sep-1 Oct 1982)			
4	*See* LBL-15071	DE83004116	MN -34C	8:13265
5	*See* LBL-14980	DE83004190	MN -34C	8:13297
CONF-820980-	(European Committee of future accelerators - the challenge of ultra-high energies conference, Oxford, UK, 27-30 Sep 1982)			
2	*See* BNL-32239	DE83004601	MN -28	8:12894
CONF-820983-	(Europhysics study conference on jet structure from quark and lepton interactions, Erice-Trapani-Sicily, Italy, 12-17 Sep 1982)			
2	*See* FERMILAB-Conf-82/86	DE83004509	MN -34D	8:13276
CONF-820985-	(8. European conference on thermophysical properties - high temperatures high pressure, Baden-Baden, F.R. Germany, 27 Sep-1 Oct 1982)			
2	*See* UCRL-87217	DE83003879	MN -11	8:13221
CONF-820988-	(Free electron laser conference, Bendor, France, 26 Sep-1 Oct 1982)			
2	*See* BNL-32086	DE83002818	MN -21	8:12864
3	*See* BNL-32087	DE83002840	MN -34	8:12937
4	*See* LA-UR-82-3621	DE83004740	MN -28	8:12865
CONF-820989-	(Workshop on science underground, Los Alamos, NM, USA, 27 Sep-1 Oct 1982)			
2	*See* LA-UR-82-3578	DE83004737	MN -34B	8:13230
CONF-820991-	(8. international workshop on weak interactions and neutrinos, Javea, Spain, 5-11 Sep 1982)			
1	*See* DOE/ER/01545-325	DE83004342	MN -34D	8:13271
CONF-820992-	(3. international kimberlite conference, Clermont-Ferrand, France, 8-11 Sep 1982)			
1	*See* LA-UR-82-3641	DE83004742	MN -11	8:13218
CONF-820993-	(Biochemical engineering conference, Santa Barbara, CA, USA, 20-24 Sep 1982)			
1	*See* SERI/TP-235-1814	DE83005107	MN -61b	8:11956
CONF-821001-	(STTFUA high-intensity solar flux measuring techniques workshop, Albuquerque, NM, USA, 26-27 Oct 1982)			
35	*See* SLAC-PUB-2996	DE83004419	MN -32	8:13566

Report No.	Availability	Order No.	Distribution Category	Abstract No.
37	*See* BNL-32175	DE83004631	MN -32	8:12939
CONF-821005-	(DOE international decommissioning symposium, Seattle, WA, USA, 10-14 Oct 1982)			
20	*See* PNL-SA-10620	DE83002754	MN -70A	8:11903
CONF-821011-	(IEEE nuclear science symposium, Washington, DC, USA, 20-22 Oct 1982)			
26	*See* BNL-32173	DE83004634	MN -37	8:12911
28	*See* SLAC-PUB-2995	DE83004154	MN -32	8:13565
29	*See* LBL-14464	DE83004117	MN -20c	8:13443
30-Rev.	*See* LBL-7520-Rev.	DE83004189	MN -48	8:13183
32	*See* LBL-14456	DE83004193	MN -37	8:12973
33	*See* SLAC-PUB-2984	DE83004416	MN -28	8:12992
34	*See* SLAC-PUB-2987	DE83004414	MN -28	8:12993
36	*See* SLAC-PUB-2972	DE83004390	MN -32	8:13564
38	*See* BNL-32174	DE83004630	MN -32	8:13117
39	*See* BNL-32208	DE83004603	MN -37	8:12943
40	*See* UCRL-86222	DE83004307	MN -37	8:12994
41	NTIS, PC A02/MF A01	DE83003007	MN -37	8:12946
CONF-821021-	(DOE statistical symposium, Idaho Falls, ID, USA, 13-14 Oct 1982)			
3	*See* PNL-SA-10897	DE83003596	MN -32	8:13559
CONF-821026-	(2. international workshop on the impact of hydrogen on water reactor safety, Albuquerque, NM, USA, 3-7 Oct 1982)			
11	*See* SAND-82-2186C	DE83001268	ND -78	8:12419
CONF-821028-	(National conference of Standards Laboratories, Gaithersburg, MD, USA, 4-7 Oct 1982)			
2	*See* SERI/TP-215-1758	DE83003101	MN -63	8:12942
CONF-821037-	(10. water reactor safety research information conference, Gaithersburg, MD, USA, 12-15 Oct 1982)			
48	*See* EGG-M-20482	DE83003225	MN -78	8:12289
51	*See* EGG-M-22482	DE83003252	MN -90c	8:11647
52	*See* EGG-M-24282	DE83003246	MN -80	8:12388
57	*See* EGG-M-18582	DE83003241	MN -78	8:12387
CONF-821038-	(10. annual DOE compatibility conference, Albuquerque, NM, USA, 26-29 Oct 1982)			
7	*See* UCRL-88465	DE83004143	MN -32	8:13536
8	*See* UCRL-88474	DE83004288	MN -25	8:13016
CONF-821040-	(53. shock and vibration symposium, Danvers, MD, USA, 26-28 Oct 1982)			
2	*See* SAND-82-1548C	DE83004134	MN -38	8:12883
CONF-821041-	(4. symposium on the transfer and utilization of particulate control, Houston, TX, USA, 11-15 Oct 1982)			
2	*See* DOE/FC-1009	DE83004340	MN -90i	8:12281
CONF-821049-	(TMS/AIME fall meeting, St. Louis, MO, USA, 24-28 Oct 1982)			
8	*See* LA-UR-82-3563	DE83004734	MN -25	8:12684
9	*See* DP-MS-82-21	DE83004921	MN -25	8:12669
10	*See* HEDL-SA-2692-FP	DE83004071	MN -20c	8:13481
CONF-821089-	(6. international workshop on laser interaction and related plasma phenomena, Monterey, CA, USA, 25-29 Oct 1982)			
5	*See* LA-UR-82-3328	DE83003536	MN -21	8:13485
6	*See* UCRL-87122	DE83004305	MN -21	8:13497
CONF-8210101-	(Workshop on in site experiments in granite associated with geological disposal of radioactive waste, Stockholm, Sweden, 25-27 Oct 1982)			
2	*See* UCRL-88254	DE83004217	MN -85	8:11854
CONF-8210102-	(International meeting on the radiobiology of radium and the actinides in man, Lake Geneva, WI, USA, 12-16 Oct 1982)			
1	*See* PNL-SA-9576	DE83002741	MN -48	8:13156
CONF-8210104-	(Quality testing manufacturing (QUALTEST I) conference, Pittsburgh, PA, USA, 4-7 Oct 1982)			
1	*See* EGG-M-15782	DE83003244	MN -38	8:12879
2	*See* EGG-M-15682	DE83003243	MN -38	8:12670
CONF-8210105-	(Annual meeting of Southeastern Association of Fish and Wildlife Agencies, Jacksonville, FL, USA, 31 Oct-3 Nov 1982)			
1	NTIS, PC A02/MF A01	DE83003482	MN -11	8:13052
CONF-8210106-	(Workshop on uses of nuclear analytical methods in metal toxicology, Upton, NY, USA, 11-12 Oct 1982)			
1	*See* BNL-32255	DE83004604	MN -48	8:13059
CONF-8210107-	(Workshop on Drell-Yan processes, Batavia, IL, USA, 7-8 Oct 1982)			
1	*See* FERMILAB-CONF-82/87	DE83004464	MN -34D	8:13259
CONF-8210108-	(Detector workshop in memory of Hans Geiger, Berlin, F.R. Germany, 6-8 Oct 1982)			
1	*See* LBL-14980	DE83004190	MN -34C	8:13297
CONF-8210109-	(Regional opportunities for research and development conference, Vancouver, Canada, 17-19 Oct 1982)			
1	*See* UCRL-88481	DE83004304	MN -13	8:13099
CONF-8210110-	(International symposium on biological dosimetry, Neherberg, F.R. Germany, 14-16 Oct 1982)			
1	*See* LA-UR-82-3658	DE83004744	MN -48	8:13152
CONF-8210111-	(Numerical astrophysics meeting, Urbana, Israel, 21-23 Oct 1982)			
	See UCRL-88475	DE83004805	MN -34B	8:13569

Report No.	Availability	Order No.	Distribution Category	Abstract No.
2	*See* LA-UR-82-3596	DE83004810	MN -34B	8:13231
CONF-8210112-	(11. conference on surface studies and 6. SUBWOG-12B technical exchange, Los Alamos, NM, USA, 5-8 Oct 1982)			
1	*See* DP-MS-82-49	DE83004919	MN -23	8:11949
CONF-8210113-	(American Physical Society meeting on pariticles and fields, College Park, MD, USA, 28-30 Oct 1982)			
1	*See* BNL-32188	DE83005147	MN -34D	8:13267
CONF-8210114-	(Annual meeting of the Society of Rheology, Evanston, IL, USA, 27 Oct 1982)			
1	*See* UCRL-88315	DE83004302	MN -34A	8:13409
CONF-821101-	(ASME winter annual meeting, Pheonix, AZ, USA, 14-19 Nov 1982)			
16	NTIS, PC A02/MF A01	DE83003480	MN -95f	8:12614
CONF-821103-	(American Nuclear Society winter meeting, Washington, DC, USA, 14-19 Nov 1982)			
49	NTIS, PC A02/MF A01	DE83003454	MN -20	8:13465
50	*See* LA-UR-82-3279	DE83003542	MN -33	8:12322
51	*See* HEDL-SA-2719	DE83004072	MN -79b	8:12370
52	*See* BNL-32212	DE83003938	MN -34C	8:12749
53	*See* PNL-SA-10574	DE83003657	MN -15	8:11941
54	*See* PNL-SA-10560	DE83003658	MN -25	8:12760
56	*See* PNL-SA-10529	DE83003456	MN -70B	8:11901
58	*See* PNL-SA-10558	DE83003461	MN -41	8:13031
59	*See* HEDL-SA-2729S	DE83004506	MN -20d	8:13482
62	*See* EGG-TIO-M-02082	DE83005274	MN -70	8:11883
CONF-821105-	(Asilomar conference, Pacific Grove, CA, USA, 8-10 Nov 1982)			
6	*See* LBL-14471	DE83003984	MN -32	8:13555
CONF-821106-	(Annual meeting of heat transfer and energy conversion, Los Angeles, CA, USA, 14-18 Nov 1982)			
20	*See* HEDL-SA-2747	DE83004505	MN -20d	8:13483
21	*See* LBL-15156	DE83004295	MN -4	8:12792
22	*See* BNL-32132	DE83003965	MN -4	8:12748
CONF-821107-	(6. international symposium on the scientific basis for radioactive waste management, Boston, MA, USA, 1-4 Nov 1982)			
30	NTIS, PC A02/MF A01	DE83003453	MN -70B	8:11866
33	NTIS, PC A02/MF A01	DE83003419	MN -70	8:11867
35	*See* SAND-82-1279C	DE83001364	MN -70	8:12688
36	*See* LBL-15220	DE83004182	MN -25	8:13404
37	*See* UCRL-88314	DE83004220	MN -34	8:12887
38	*See* SAND-82-1439C	DE83005006	MN -70	8:11909
39	*See* LBL-14916	DE83004181	MN -38	8:12974
40	*See* SAND-82-2259C	DE83005008	MN -70	8:11910
41	NTIS MF A01	DE83004678	MN -25	8:12731
42	*See* DP-MS-82-40	DE83004928	MN -70	8:11879
43	*See* EGG-M-22882	DE83005276	MN -70B	8:11882
44	*See* DP-MS-82-42	DE83002687	MN -70	8:11880
CONF-821111-	(29. national symposium on American Vacuum Society, Baltimore, MD, USA, 16-19 Nov 1982)			
2-Rev.1	*See* UCRL-87735-Rev.1	DE83004285	MN -20	8:13498
19	*See* GA-A-16885	DE83004679	MN -20c	8:13479
20	*See* BNL-32167	DE83003961	MN -28	8:12938
CONF-821119-	(International symposium on recent advances in nuclear materials safeguards, Nienna, Australia, 8-12 Nov 1982)			
11	*See* HEDL-SA-2765-FP	DE83004068	MN -15	8:11937
CONF-821120-	(Conference on material preparation and characterization capabilities, Oak Ridge, TN, USA, 16-18 Nov 1982)			
1	*See* UCRL-88334	DE83004318	MN -25	8:12742
CONF-821123-	(7. conference on the application of accelerators in research and industry, Denton, TX, USA, 8-10 Nov 1982)			
22	*See* BNL-32237	DE83004590	MN -23	8:12912
23	*See* LBL-14624	DE83004192	MN -28	8:12896
24	*See* LBL-14623	DE83004191	MN -28	8:12925
25	*See* LA-UR-82-3330	DE83003535	MN -37	8:12971
26	*See* UCRL-87760	DE83004310	MN -34B	8:12909
27	*See* BNL-32169	DE83003956	MN -28	8:12910
28	*See* LA-UR-82-3267	DE83003565	MN -28	8:12906
30	*See* UCRL-87768	DE83004301	MN -34D	8:12934
CONF-821124-	(5. symposium on physics and technology of compact toroids in the magnetic fusion energy program, Belevue, WA, USA, 16-18 Nov 1982)			
6	*See* LA-UR-82-3380	DE83003533	MN -20g	8:13442
7	*See* LA-UR-82-3289	DE83003568	MN -20d	8:13437
8	*See* LA-UR-82-3290	DE83003569	MN -20d	8:13438
9	*See* LA-UR-82-3317	DE83003575	MN -20f	8:13439
10	*See* LA-UR-82-3323	DE83003540	MN -20f	8:13440
11	*See* LA-UR-82-3324	DE83003537	MN -20f	8:13441
12	NTIS, PC A02/MF A01	DE83005072	MN -20b	8:13419
13	NTIS, PC A02/MF A01	DE83005071	MN -20b	8:13466
14	NTIS, PC A02/MF A01	DE83002558	MN -20a	8:13420
CONF-821128-	(24. American Physical Society annual meeting, New Orleans, LA, USA, 1-5 Nov 1982)			
2	NTIS, PC A03/MF A01	DE83003397	MN -21	8:13467

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CONF-821133-	(Conference on ceramic science - emergent process methods for high technology ceramics, Raleigh, NC, USA, 8-10 Nov 1982)			
2	*See* UCRL-88181	DE83003876	MN -4	8:12716
3	*See* SAND-82-1483C	DE83003008	MN -25	8:12715
CONF-821136-	(4. international conference on precipitation scavenging, dry deposition and resuspension, Santa Monica, CA, USA, 29 Nov-3 Dec 1982)			
5	*See* PNL-SA-10917	DE83003597	MN -11	8:13024
6	NTIS, PC A02/MF A01	DE83004646	MN -11	8:13020
7	*See* PNL-SA-10684	DE83003462	MN -11	8:13047
CONF-821152-	(International symposium on mathematical ecology, Trieste, Italy, 29 Nov-10 Dec 1982)			
1	NTIS, PC A02/MF A01	DE83004645	MN -48	8:13073
CONF-821154-	(Group theoretical methods in physics seminar, Moscow, USSR, 24-26 Nov 1982)			
1	*See* LA-UR-82-3338	DE83003638	MN -34D	8:13407
CONF-821156-	(3. energy conserving greenhouse conference, Hyannis, MA, USA, 19-21 Nov 1982)			
1	*See* LA-UR-82-3634	DE83004741	MN -59c	8:12162
CONF-821157-	(DOE mini/microcomputer information interchange conference, Los Alamos, NM, USA, 3-5 Nov 1982)			
1	*See* DP-MS-82-48	DE83004918	MN -32	8:13547
CONF-821201-	(Fall DECUS US Symposium, Anaheim, CA, USA, 6-10 Dec 1982)			
6	*See* UCRL-88359	DE83004141	MN -32	8:13568
7	*See* LA-UR-82-3398	DE83003560	MN -32	8:13552
8	*See* LA-UR-82-3322	DE83003539	MN -32	8:13550
9	*See* LA-UR-82-3334	DE83003534	MN -32	8:13551
10	*See* UCRL-87728	DE83004208	MN -38	8:13008
11	*See* LA-UR-82-3550	DE83004732	MN -32	8:13553
CONF-821204-	(International symposium on remote sensing of environment, Ft Worth, TX, USA, 6-10 Dec 1982)			
1-Rev.1	*See* UCRL-87802-Rev.1	DE83003018	MN -66b	8:12202
CONF-821205-	(NWTS information meeting on basalt waste isolation project, Las Vegas, NV, USA, 14-16 Dec 1982)			
27	*See* SAND-82-2866C	DE83004011	MN -70	8:11911
CONF-821209-	(5. annual symposium on uranium mill tailings management, Ft. Collins, CO, USA, 9-10 Dec 1982)			
3	*See* PNL-SA-10534	DE83005248	MN -70A	8:11902
CONF-821211-	(5. DOE battery and electrochemical contractor's conference, Crystal City, VA, USA, 7-9 Dec 1982)			
3	*See* BNL-32190	DE83003959	MN -94ca	8:12458
4	*See* BNL-32172	DE83003960	MN -94cc	8:12520
CONF-821212-	(Mirror advanced reactor study meeting, Livermore, CA, USA, 6-7 Dec 1982)			
Suppl.	NTIS, PC A15/MF A01	DE83004806	MN -20	8:13468
CONF-821213-	(5. international conference on alternative energy source, Miami Beach, FL, USA, 13-15 Dec 1982)			
2	NTIS, PC A02/MF A01	DE83004644	MN -96	8:12041
3	NTIS, PC A02/MF A01	DE83004616	MN -95d	8:12557
CONF-821214-	(8. geothermal reservoir engineering workshop, Stanford, CA, USA, 14-16 Dec 1982)			
2	*See* LA-UR-82-3584	DE83004808	MN -66b	8:12245
CONF-821215-	(DOE environmental protection information meeting, Denver, CO, USA, 7-9 Dec 1982)			
2	*See* LA-UR-82-3483	DE83004727	MN -11	8:11927
3	*See* LA-UR-82-3488	DE83004728	MN -11	8:13042
4	*See* LA-UR-82-3489	DE83004729	MN -11	8:13028
5	*See* LA-UR-82-3500	DE83004730	MN -11	8:13065
6	*See* UCRL-88425	DE83003880	MN -41	8:13092
7	*See* LA-UR-82-3681	DE83004746	MN -11	8:13043
CONF-821216-	(Joint US/Japan Power Reactor and Nuclear Fuel Development Corporation conference, Tokyo, Japan, 6-17 Dec 1982)			
1	NTIS MF A01	DE83004607	MN -83	8:12839
2	NTIS, PC A03/MF A01	DE83004652	MN -83	8:11820
3	NTIS, PC A02/MF A01	DE83004510	MN -38	8:12840
4	NTIS, PC A02/MF A01	DE83004609	MN -38	8:12841
6	NTIS, PC A03/MF A01	DE83004608	MN -38	8:12842
8	NTIS, PC A02/MF A01	DE83004507	MN -38	8:12843
9	NTIS, PC A02/MF A01	DE83004508	MN -38	8:12844
CONF-821217-	(ASHRAE/DOE conference on thermal performance of building envelopes, Las Vegas, NV, USA, 5-9 Dec 1982)			
1	NTIS, PC A03/MF A01	DE83004462	MN -95d	8:12558
2	NTIS, PC A02/MF A01	DE83004463	MN -95d	8:12559
CONF-821218-	(Workshop on mechanisms of migration in fishes, Acquafredda di Maratea, Italy, 13-17 Dec 1982)			
1	NTIS, PC A03/MF A01	DE83004651	MN -11	8:13102
CONF-821219-	(International conference on metastable and modulated semiconductor structures, Pasadena, CA, USA, 6-10 Dec 1982)			
1	*See* SAND-82-1847C	DE83003915	MN -34	8:12741
2	*See* SAND-82-1874C	DE83003917	MN -34	8:12886
CONF-821220-	(Seminar on energy policies and programs, Oak Ridge, TN, USA, 3 Dec 1982)			
1	NTIS, PC A03/MF A01	DE83004650	MN -98F	8:12491

Report No.	Availability	Order No.	Distribution Category	Abstract No.
CONF-821221-	(American Geophysical Union conference, San Francisco, CA, USA, 6 Dec 1982)			
1	*See* RHO-BW-SA-269-P	DE83004676	MN -70	8:11906
CONF-821222-	(COMES international passive solar research and design conference, Cannes, France, 13-16 Dec 1982)			
1	*See* LA-UR-82-3525	DE83004731	MN -59c	8:12161
CONF-821223-	(3. conference on rapid solidification processing: principles and technologies, Gaithersburg, MD, USA, 6-8 Dec 1982)			
1	*See* UCRL-88400	DE83003884	MN -25	8:12691
CONF-821224-	(Combustion Institute fall technical meeting on chemical and physical processes in combustion, Atlantic City, NJ, USA, 14-16 Dec 1982)			
1	*See* BNL-32178	DE83003958	MN -11	8:13018
CONF-830112-	(21. aerospace sciences meeting of the American Insitute of Aeronautics and Astronautics, Reno, NV, USA, 10-13 Jan 1983)			
1	*See* DOE/NASA/10769-28	DE83003670	STD -90g	8:12516
CONF-830113-	(Measurement science conference, Palo Alto, CA, USA, 20-21 Jan 1983)			
1	*See* Y/IA-156	DE83004061	MN -37	8:12888
CONF-830114-	(Energy from biomass and wastes symposium, Lake Buena Vista, FL, USA, 24-28 Jan 1983)			
1	*See* LA-UR-82-3566	DE83004735	MN -61a	8:12063
CONF-830115-	(9. annual conference on explosives and blasting techniques, Dallas, TX, USA, 31 Jan-4 Feb 1983)			
1	*See* SAND-82-2187C	DE83005007	MN -91	8:13220
CONF-830201-	(Society of Automotive Engineers congress, Detroit, MI, USA, 28 Feb-4 Mar 1983)			
1-DRAFT	*See* SAND-82-7092C	DE83002513	MN -96	8:12651
2	*See* UCRL-88233	DE83004306	MN -96	8:12647
2-Rev.1	*See* UCRL-88233-Rev.1	DE83003878	MN -96	8:12643
CONF-830202-	(ISSCO user's group meeting, San Diego, CA, USA, 28 Feb-1 Mar 1983)			
1	*See* LA-UR-82-3657	DE83004743	MN -32	8:13554
CONF-830203-	(IADC/SPE drilling conference, New Orleans, LA, USA, 20-23 Feb 1983)			
1	*See* LA-UR-82-3682	DE83004812	MN -66c	8:12246
2	*See* SAND-82-1711C	DE83004012	MN -11	8:13213
COO-				
2218-261	*See* CONF-821124-12	DE83005072	MN -20b	8:13419
2218-262	*See* CONF-821124-13	DE83005071	MN -20b	8:13466
2218-263	*See* CONF-821124-14	DE83002558	MN -20a	8:13420
3221-74	*See* DOE/EV/03221-74	DE83004778	MN -48	8:13180
3227-76	*See* DOE/ER/03227-76	DE83004683	MN -34D	8:13272
4506-5	*See* DOE/ET/25402-T1	DE83004684	MN -94cb	8:12460
CRA-				
489.06-Vol.1	NTIS, PC A07/MF A01	DE83004936	MN -98F	8:11789
489.06-Vol.2	NTIS, PC A03/MF A01	DE83004937	MN -98F	8:11790
CRN-				
82-01	NTIS (US Sales Only), MF A01	DE83900866	MN -34	8:12471
CTA-EAV-NT-				
003/ 81	NTIS (US Sales Only), PC A02/MF A01	DE82703351	MN -79	8:12312
004/ 81	NTIS (US Sales Only), PC A02/MF A01	DE82703352	MN -79	8:12313
DESY-				
82-022	NTIS (US Sales Only), PC A02/MF A01	DE82750927	MN -34D	8:13255
82-023	NTIS (US Sales Only), PC A02/MF A01	DE82750926	MN -34D	8:13256
82-024	NTIS (US Sales Only), PC A02/MF A01	DE82750925	MN -34D	8:13269
82-025	NTIS (US Sales Only), PC A02/MF A01	DE82750924	MN -34D	8:13270
DESY-SR-				
82-02	NTIS (US Sales Only), PC A02/MF A01	DE82750938	MN -25	8:12662
82-04	NTIS (US Sales Only), PC A02/MF A01	DE82750939	MN -25	8:12732
DFVLR-MITT-				
81-28	Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Koeln, Germany			8:13021
DOE/AD/11257-				
T1	NTIS, PC A09/MF A01	DE83004687	MN -98	8:12464
DOE/AF/92017-				
T2	NTIS, PC A02/MF A01	DE82018727	MN -61a	8:12617
DOE/AL/10563-				
T15	NTIS, PC A05/MF A01	DE83003858	MN -66a	8:12242
T16	NTIS, PC A04/MF A01	DE83003838	MN -66a	8:12243
DOE/BC/10100-				
4	NTIS, PC A03/MF A01	DE83005239	STD -92a	8:11796
DOE/BC/10102-				
1	NTIS, PC A12/MF A01	DE83003617	STD -92b	8:11809
DOE/CH/00135-				
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2	NTIS, PC A03/MF A01	DE83005844	MN -64	8:12130
4	NTIS, PC A03/MF A01	DE83005840	MN -64	8:12131
DOE/CH/10116-				
1	NTIS, PC A02/MF A01	DE83004800	MN -59c	8:12134
DOE/CH/10122-				
7	NTIS, PC A15/MF A01	DE83001147	MN -59	8:12135
DOE/CS/14287-				
T2	NTIS, PC A04/MF A01	DE83001278	STD -63	8:12176

Report No.	Availability	Order No.	Distribution Category	Abstract No.
DOE/CS/20009-1	NTIS, PC A03/MF A01	DE83005124	STD -95e	8:12627
2	NTIS, PC A03/MF A01	DE83004897	MN -95e	8:12628
DOE/CS/20234-2	NTIS, PC A05/MF A01	DE83004751	STD -95e	8:12629
DOE/CS/20291-4	NTIS, PC A04/MF A01	DE83005123	STD -95e	8:12630
DOE/CS/20544-1	NTIS, PC A10/MF A01	DE83004948	STD -95e	8:12631
DOE/CS/21348-T1	NTIS, PC A05/MF A01	DE83002162	MN -95	8:12548
DOE/CS/22004-T1	Sam Davis, AIA, Univ. of California, Berkeley		ND -95d	8:12560
DOE/CS/24311-1	NTIS, PC A03/MF A01	DE83004750	STD -95e	8:12632
DOE/CS/24317-2	NTIS MF A01	DE83003840	STD -95e	8:12633
DOE/CS/24448-T1	NTIS, PC A07/MF A01	DE83003921	MN -95f	8:12618
DOE/CS/24456-2	NTIS, PC A10/MF A01	DE83004949	STD -95e	8:12634
DOE/CS/30013-U12	NTIS MF A01	DE83005339	STD -98E	8:12014
U13	NTIS, PC A99/MF A01	DE83005499	STD -98E	8:12635
U14	NTIS MF A01	DE83005498	STD -98E	8:11781
U16	NTIS, PC A99/MF A01	DE83005409	STD -90e	8:12636
DOE/CS/30131-T1	NTIS MF A01	DE83005113	STD -63e	8:12177
DOE/CS/30149-5	NTIS, PC A03/MF A01	DE83004768	STD -95e	8:12637
DOE/CS/30339-T1	NTIS, PC A07/MF A01	DE83004512	MN -59a	8:12152
DOE/CS/30386-T1	NTIS MF A01	DE83004108	MN -59a	8:12153
DOE/CS/34285-T1	NTIS, PC A04/MF A01	DE83005112	STD -63e	8:12178
DOE/CS/40095-T1	NTIS, PC A05/MF A01	DE82021237	MN -95f	8:12619
DOE/CS/40310-T1	NTIS, PC A03/MF A01	DE82019281	MN -25	8:12663
DOE/CS/40327-T3	NTIS, PC A06/MF A01	DE83003725	MN -95f	8:12620
T4	NTIS, PC A08/MF A01	DE83003594	MN -95f	8:12621
DOE/CS/40337-8	NTIS, PC A02/MF A01	DE83005082	MN -95f	8:12638
9	NTIS, PC A04/MF A01	DE83005081	MN -95e	8:12639
DOE/CS/50045-T1	NTIS, PC A05/MF A01	DE82021175	MN -96	8:12650
DOE/CS/50108-1	NTIS, PC A06/MF A01	DE83004873	MN -96	8:12612
DOE/CS/54209-10	NTIS, PC A13/MF A01	DE83003283	STD -96	8:12459
DOE/CS/83001-T1	NTIS, PC A02/MF A01	DE83003611	MN -61a	8:11970
DOE/DP/40030-4	NTIS, PC A11/MF A01	DE83004635	MN -21	8:13471
DOE/EA-0106	NTIS, PC A10/MF A01	DE83005845	STD -22	8:11921
DOE/EIA-0131-81	NTIS, PC A04/MF A01	DE83004759	STD -92	8:11818
DOE/EIA/10683-T1	NTIS, PC A05/MF A01	DE83003798	MN -98F	8:11932
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DOE/EP-0081	NTIS, PC A05/MF A01	DE83005271	MN -13	8:11810
DOE/EP/12040-T1	NTIS, PC A04/MF A01	DE82015865	MN -41	8:13140
DOE/ER-0155	NTIS MF A01	DE83004442	STD -13	8:12465
DOE/ER/01198-1395	NTIS, PC A14/MF A01	DE83005236	MN -25	8:12706
1396	NTIS, PC A09/MF A01	DE83005232	MN -25	8:12707
DOE/ER/01388-883	NTIS, PC A02/MF A01	DE83004871	MN -34	8:13292
DOE/ER/01545-325	NTIS, PC A02/MF A01	DE83004342	MN -34D	8:13271
DOE/ER/02001-T1	NTIS, PC A02/MF A01	DE83005056	MN -4	8:12819
DOE/ER/02172-39	NTIS MF A01	DE83004495	MN -25	8:12664
DOE/ER/02184-T1	NTIS, PC A02/MF A01	DE83004522	MN -34C	8:13349

Report No.	Availability	Order No.	Distribution Category	Abstract No.
DOE/ER/02408-208	NTIS, PC A04/MF A01	DE83004558	MN -34C	8:13294
209	NTIS, PC A03/MF A01	DE83004559	MN -34A	8:12915
212	NTIS, PC A03/MF A01	DE83004561	MN -34C	8:13235
213	NTIS, PC A03/MF A01	DE83004562	MN -34C	8:13236
DOE/ER/03077-176	NTIS, PC A04/MF A01	DE83004386	MN -32	8:13413
DOE/ER/03227-76	NTIS, PC A02/MF A01	DE83004683	MN -34D	8:13272
DOE/ER/03285-44	NTIS, PC A02/MF A01	DE83005268	MN -34D	8:13286
DOE/ER/03443-T1	NTIS, PC A02/MF A01	DE83003089	MN -32	8:13544
DOE/ER/03956-T1	NTIS, PC A03/MF A01	DE83004705	MN -34D	8:13257
DOE/ER/04447-152	NTIS, PC A03/MF A01	DE83004574	MN -4	8:12775
DOE/ER/04900-3	NTIS, PC A02/MF A01	DE83004426	MN -4	8:12802
DOE/ER/05490-32	NTIS, PC A02/MF A01	DE83005265	MN -34D	8:13287
37	NTIS, PC A03/MF A01; 1	DE83005132	MN -34D	8:13250
DOE/ER/10065-3T	NTIS, PC A03/MF A01	DE83005010	MN -38	8:12645
DOE/ER/10343-04	NTIS, PC A02/MF A01	DE83002205	MN -94a	8:12452
DOE/ER/10361-3-3A	NTIS, PC A02/MF A01	DE83003764	MN -11	8:13217
DOE/ER/10428-4	NTIS, PC A02/MF A01	DE83004682	MN -25	8:12665
T2	NTIS, PC A02/MF A01	DE83004813	MN -25	8:12708
T3	NTIS, PC A02/MF A01	DE83004814	MN -25	8:12666
DOE/ER/10435-2	NTIS, PC A02/MF A01	DE83004869	MN -4	8:12829
DOE/ER/10485-T2	NTIS, PC A02/MF A01	DE83005085	MN -4	8:12776
DOE/ER/10494-4	NTIS, PC A03/MF A01	DE83005474	MN -4	8:13322
DOE/ER/10528-3	NTIS, PC A02/MF A01	DE83005187	MN -34D	8:13273
DOE/ER/10556-92	NTIS, PC A03/MF A01	DE83004083	MN -25	8:13402
DOE/ER/10587-2	NTIS, PC A02/MF A01	DE83004333	MN -34D	8:13274
DOE/ER/10604-3	NTIS, PC A02/MF A01	DE83004588	MN -4	8:12803
DOE/ER/10614-2	NTIS, PC A03/MF A01	DE83005138	STD -66d	8:12240
DOE/ER/10624-3	NTIS, PC A02/MF A01	DE83003048	MN -4	8:12804
DOE/ER/10638-3	NTIS, PC A07/MF A01	DE83004563	MN -34C	8:13295
DOE/ER/10697-T1	NTIS, PC A03/MF A01	DE83002858	MN -48	8:13134
DOE/ER/10714-2	NTIS, PC A04/MF A01	DE83004569	MN -34C	8:13302
DOE/ER/10740-8	NTIS, PC A07/MF A01	DE83005066	MN -25	8:12667
DOE/ER/10841-5	NTIS, PC A02/MF A01	DE83004424	MN -32	8:13414
DOE/ER/10878-T1	NTIS, PC A02/MF A01	DE83004389	MN -61a	8:11971
DOE/ER/10879-2	NTIS, PC A02/MF A01	DE83004900	MN -61a	8:12042
DOE/ER/10881-T1	NTIS, PC A02/MF A01	DE83003909	MN -4	8:12733
DOE/ER/10939-2	NTIS MF A01	DE83004899	MN -63e	8:12043
DOE/ER/10946-3	NTIS, PC A02/MF A01	DE83004379	MN -34A	8:12916
DOE/ER/10985-1	NTIS, PC A02/MF A01	DE83004079	MN -34A	8:13237
DOE/ER/12017-4	NTIS, PC A03/MF A01	DE83004902	MN -11	8:13206
6	NTIS, PC A02/MF A01	DE83004894	MN -11	8:13060
DOE/ER/12028-1	NTIS, PC A03/MF A01	DE83002735	MN -11	8:13126
DOE/ER/12044-1	NTIS, PC A03/MF A01	DE83003586	MN -34C	8:12709
DOE/ER/12064-1	NTIS, PC A02/MF A01	DE83004523	MN -34	8:12734
DOE/ER/40039-6	NTIS, PC A03/MF A01	DE83003707	MN -34D	8:12947
DOE/ER/40048-11-L2	NTIS, PC A02/MF A01	DE83004933	MN -34C	8:13344

Report No.	Availability	Order No.	Distribution Category	Abstract No.
17-P2	NTIS, PC A02/MF A01; 1	DE83004929	MN -34D	8:13275
20P2	NTIS, PC A02/MF A01	DE83004923	MN -34D	8:13288
21-L2	NTIS, PC A02/MF A01	DE83004922	MN -34D	8:13355
25-L2	NTIS, PC A04/MF A01	DE83004920	MN -34C	8:13315
27-L2	NTIS, PC A03/MF A01	DE83004106	MN -34C	8:13316
28-L2	NTIS, PC A02/MF A01	DE83004916	MN -34D	8:13227
30-L2	NTIS, PC A02/MF A01	DE83004905	MN -34B	8:13228
DOE/ER/53091-T5	NTIS, PC A02/MF A01	DE83004105	MN -20a	8:13472
DOE/ER/53136-2	NTIS, PC A02/MF A01	DE83004643	MN -20g	8:13421
DOE/ER/53140-5	NTIS, PC A02/MF A01	DE83005090	MN -20g	8:13422
DOE/ER/54008-T1	NTIS, PC A06/MF A01	DE83004216	MN -20	8:13473
DOE/ER/71294-T2	NTIS, PC A02/MF A01	DE83004402	MN -4	8:11598
DOE/ES-0004	NTIS, PC A03/MF A01	DE83005326	MN -13	8:12487
DOE/ET/10069-T21	NTIS (US Sales Only), PC A06/MF A01	DE83001390	STD -90d	8:11599
DOE/ET/10159-T18	NTIS, PC A18/MF A01	DE83000831	MN -89	8:11600
T25	NTIS, PC A18/MF A01	DE83002171	MN -90	8:11579
DOE/ET/10555-T1	NTIS, PC A03/MF A01	DE83005307	STD -90d	8:11612
DOE/ET/10587-T1-Pt.3	NTIS, PC A05/MF A01	DE83004597	STD -90d	8:11613
DOE/ET/10815-75	NTIS, PC A04/MF A01	DE83004815	STD -90g	8:12513
77	NTIS, PC A03/MF A01	DE83004816	STD -90g	8:12514
DOE/ET/11430-T1	NTIS, PC A08/MF A01	DE83003361	STD -90c	8:11614
DOE/ET/12103-T4	NTIS, PC A09/MF A01	DE82021084	STD -90d	8:11615
DOE/ET/12231-T1	NTIS, PC A05/MF A01	DE83002773	STD -93	8:12521
DOE/ET/12457-T10	NTIS, PC A03/MF A01	DE83005277	STD -88	8:12845
DOE/ET/12548-13	NTIS, PC A04/MF A01	DE83005137	STD -88	8:11716
15	NTIS, PC A11/MF A01	DE83005143	STD -88	8:11717
DOE/ET/13046-T82	NTIS, PC A03/MF A01	DE83003159	MN -89	8:11682
DOE/ET/14102-4	NTIS, PC A10/MF A01	DE83005440	STD -91	8:11825
DOE/ET/14801-30	NTIS, PC A16/MF A01	DE83001643	STD -90d	8:11616
DOE/ET/14803-T7	NTIS, PC A09/MF A01	DE83004460	STD -90d	8:11617
DOE/ET/14804-Q7	NTIS, PC A09/MF A01	DE83005273	STD -90d	8:11618
DOE/ET/14809-12	NTIS, PC A03/MF A01	DE83004347	STD -90d	8:11960
DOE/ET/14880-T2	NTIS, PC A03/MF A01	DE83003637	MN -90d	8:11619
DOE/ET/15397-T5	NTIS MF A01	DE83003302	MN -96	8:12646
DOE/ET/15420-T1	NTIS, PC A03/MF A01	DE83004388	MN -93	8:12517
DOE/ET/15614-2	NTIS, PC A03/MF A01; 1	DE82006211	STD -90g	8:12515
DOE/ET/20279-170	NTIS, PC A07/MF A01	DE83004946	STD -63	8:12109
180-Vol.5	NTIS, PC A10/MF A01	DE83005246	STD -63d	8:12110
222	NTIS, PC A06/MF A01	DE83004695	STD -63	8:12111
DOE/ET/20356-7	NTIS MF A01	DE83005142	STD -63	8:12012
DOE/ET/21106-T1	NTIS MF A01	DE83000948	MN -62	8:12119
DOE/ET/23197-T9	NTIS, PC A03/MF A01	DE83004194	MN -63	8:12044
DOE/ET/25207-1	NTIS, PC A05/MF A01	DE83003584	MN -94cc	8:12814
DOE/ET/25402-T1	NTIS, PC A02/MF A01	DE83004684	MN -94cb	8:12460
DOE/ET/27204-T1-Vol.2-App.Sect.1	NTIS, PC A04	DE83003220	MN -66a	8:12215
DOE/ET/27217-1	NTIS, PC A03/MF A01	DE83005096	STD -66a	8:12244
2-Vol.1	NTIS MF A01	DE83005095	STD -66a	8:12197
DOE/ET/29101-33	NTIS, PC A02/MF A01	DE83004885	MN -38	8:12285
DOE/ET/29354-3	NTIS, PC A07/MF A01	DE83004801	MN -25	8:12668

Report No.	Availability	Order No.	Distribution Category	Abstract No.
DOE/ET/34013-5	NTIS (US Sales Only), PC A04/MF A01	DE83004278	STD -78	8:12334
DOE/ET/34015-4	NTIS, PC A03/MF A01	DE83004803	MN -78	8:12302
DOE/ET/34030-4	NTIS (US Sales Only), PC A07/MF A01	DE83003393	MN -78	8:12303
DOE/ET/37240-98TR-Pt.1	NTIS, PC A10/MF A01	DE83003272	MN -79b	8:12314
98TR-Pt.2	NTIS, PC A10/MF A01	DE83003273	MN -79b	8:12315
DOE/ET/47916-1-Vol.4	NTIS, PC A02/MF A01	DE83003869	MN -85	8:11850
DOE/ET/51013-59	NTIS, PC A11/MF A01	DE83005441	MN -20f	8:13423
62	NTIS, PC A05/MF A01	DE83005238	STD -20g	8:13474
DOE/ET/53042-13	NTIS, PC A02/MF A01	DE83000160	MN -20f	8:13475
DOE/EV/03221-73	NTIS MF A01	DE83004779	MN -48	8:13006
74	NTIS, PC A02/MF A01	DE83004778	MN -48	8:13180
75	NTIS, PC A04/MF A01	DE83004799	MN -48	8:12820
DOE/EV/03380-38	NTIS, PC A05/MF A01	DE83004642	MN -48	8:13141
DOE/EV/03522-25	NTIS, PC A09/MF A01	DE82021625	MN -48	8:13380
DOE/EV/04024-T1	NTIS, PC A02/MF A01	DE83003400	MN -48	8:13130
DOE/EV/04267-06	NTIS, PC A05/MF A01	DE83004578	MN -41	8:13181
DOE/EV/05888-05	NTIS, PC A02/MF A01	DE83004557	MN -48	8:13182
DOE/EV/10019-6	NTIS MF A01	DE83003029	STD -11	8:13025
16-Vol.2	NTIS, PC A03/MF A01	DE83004723	STD -11	8:13061
DOE/EV/10270-3	NTIS, PC A02/MF A01	DE83004870	MN -48	8:13118
DOE/EV/10306-T3	NTIS, PC A03/MF A01	DE83003872	MN -11	8:13083
DOE/EV/10450-T1	NTIS, PC A07/MF A01	DE83005069	MN -61a	8:12045
T2	NTIS, PC A06/MF A01	DE83005068	MN -63a	8:12046
T3	NTIS, PC A04/MF A01	DE83005067	MN -61a	8:12047
T4	NTIS, PC A07/MF A01	DE83005070	MN -41	8:13026
DOE/EV/10502-2	NTIS, PC A05/MF A01	DE83005243	MN -11	8:13027
3	NTIS, PC A04/MF A01	DE83005114	STD -11	8:13080
DOE/EV/10611-2	NTIS, PC A02/MF A01	DE83004868	MN -11	8:13081
DOE/EV/72002-58	NTIS, PC A02/MF A01	DE83004911	MN -48	8:13103
DOE/FC-1009	NTIS, PC A02/MF A01	DE83004340	MN -90i	8:12281
DOE/FC/10200-T4	NTIS, PC A14/MF A01	DE83005165	STD -90i	8:11683
T5	NTIS, PC A05/MF A01	DE83005164	STD -90i	8:12282
DOE/FC/10297-T4	NTIS, PC A02/MF A01	DE83001864	MN -90i	8:11684
DOE/FE/00080-7	NTIS, PC A03/MF A01	DE83004850	STD -88	8:11731
DOE/FE/00103-T1	NTIS, PC A03/MF A01	DE83004706	STD -90b	8:11751
DOE/FE/05147-T11	NTIS, PC A03/MF A01	DE83003064	STD -90c	8:11620
DOE/FE/14185-T4	NTIS, PC A05/MF A01	DE82021797	MN -90i	8:11732
DOE/FE/15066-1199	NTIS, PC A16/MF A01	DE83003020	STD -90c	8:11621
DOE/GET-83/1	NTIS	DE83002686	STD -66	8:12182
DOE/ID/12030-T3	NTIS, PC A10/MF A01	DE83004641	MN -66a	8:12198
DOE/ID/12044-T1	NTIS, PC A03/MF A01	DE83004447	MN -11	8:13207
T2	NTIS, PC A03/MF A01	DE83004312	MN -11	8:13208
DOE/ID/12065-T1	NTIS, PC A08/MF A01	DE83003448	MN -66a	8:12199
DOE/ID/12274-T1-Vol.6	NTIS, PC A20/MF A01	DE83000772	MN -61	8:12048
DOE/ID/12325-4	NTIS, PC A02/MF A01	DE83005011	MN -61a	8:11972
DOE/ID/12332-T1	NTIS, PC A08/MF A01	DE83005260	MN -61a	8:11973
DOE/IR/11160-T1	NTIS, PC A02/MF A01	DE83004281	MN -96	8:12613
DOE/JPL-1060-56	NTIS, PC A05/MF A01	DE83005140	STD -62b	8:12179

Report No.	Availability	Order No.	Distribution Category	Abstract No.
956205-82/ 2	NTIS, PC A02/MF A01	DE83004844	MN -63b	8:12049
DOE/JPL/955909-82/ 8	NTIS, PC A03/MF A01	DE83005088	STD -63b	8:12050
DOE/LC/10705-T1	NTIS, PC A09/MF A01	DE83005075	STD -90c	8:11622
DOE/LC/RI-83-1	NTIS MF A01	DE83005076	STD -90c	8:11623
DOE/LLW-6T	NTIS, PC A04/MF A01	DE83003145	STD -70B	8:11868
12T	NTIS, PC A04/MF A01	DE83003314	STD -70B	8:11872
15T	NTIS, PC A06/MF A01	DE83005161	STD -70B	8:11851
DOE/MA-0090	NTIS, PC A05/MF A01	DE83004396	MN -13	8:13534
DOE/MC/14101-1126	NTIS, PC A13/MF A01	DE83003087	STD -90b	8:11752
DOE/MC/14273-1318	NTIS MF A01	DE83005059	STD -89	8:11624
DOE/MC/14705-3	NTIS, PC A06/MF A01	DE83005214	MN -90c	8:11625
DOE/MC/16022-1307	NTIS, PC A03/MF A01	DE83004031	STD -90a	8:11626
DOE/MC/16024-T4	NTIS, PC A03/MF A01	DE83004519	MN -90c	8:11627
DOE/MC/16140-T2	NTIS, PC A02/MF A01	DE83000436	MN -92a	8:11797
DOE/MC/16229-T5	NTIS, PC A03/MF A01	DE82019415	MN -90i	8:11685
DOE/MC/16463-1324	NTIS, PC A09/MF A01	DE83005412	STD -92a	8:11816
DOE/NASA-0241-5	NTIS, PC A03/MF A01	DE83005613	MN -93	8:12522
DOE/NASA/10769-28	NTIS, PC A02/MF A01	DE83003670	STD -90g	8:12516
DOE/NASA/20485-13	NTIS, PC A02/MF A01	DE83005103	STD -63	8:12015
DOE/NBB-0020	NTIS MF A01	DE83005452	MN -88	8:11783
DOE/NBM-2021934	NTIS, PC A05/MF A01	DE82021934	MN -58b	8:12640
DOE/NE-0048	NTIS, PC A06/MF A01	DE83004130	MN -80	8:12335
DOE/NV/00410-68	NTIS, PC A05/MF A01	DE83005242	MN -70B	8:11873
DOE/NV/10194-1	NTIS MF A01	DE83004777	MN -66a	8:12186
2	NTIS MF A01	DE83004776	MN -66a	8:12229
3	NTIS, PC A03/MF A01	DE83004785	MN -66a	8:12200
DOE/NV/10249-3	NTIS, PC A04/MF A01	DE83004133	STD -92a	8:11817
DOE/NV/10250-4	NTIS, PC A03/MF A01	DE83004754	MN -70	8:11874
5	NTIS, PC A04/MF A01	DE83004770	MN -70	8:11875
DOE/OR/00033-T12	NTIS, PC A03/MF A01	DE83004580	MN -11	8:13037
DOE/PC/30076-T4	NTIS, PC A03/MF A01	DE83003755	MN -94b	8:11753
DOE/PC/30080-8	NTIS, PC A10/MF A01	DE83004849	STD -90d	8:11628
DOE/PC/30205-4	NTIS, PC A05/MF A01	DE83003227	STD -88	8:11733
DOE/PC/30223-6	NTIS, PC A02/MF A01	DE83004282	MN -90a	8:11669
DOE/PC/30298-T9	NTIS, PC A02/MF A01	DE83004183	MN -90i	8:11961
DOE/PC/30300-T6	NTIS MF A01	DE83004685	MN -90e	8:12830
T7	NTIS, PC A02/MF A01	DE83003787	MN -90e	8:11766
DOE/PC/40009-T1	NTIS, PC A02/MF A01	DE83004595	MN -90d	8:11629
T2	NTIS, PC A03/MF A01	DE83004596	MN -90d	8:11630
T3	NTIS, PC A02/MF A01	DE83004526	MN -90d	8:11631
DOE/PC/40077-4	NTIS, PC A03/MF A01	DE83004091	MN -90d	8:11962
5	NTIS, PC A05/MF A01	DE83004092	MN -90d	8:11963
DOE/PC/40783-T8	NTIS, PC A02/MF A01	DE83002685	STD -90a	8:11670
DOE/PC/40789-T4	NTIS, PC A02/MF A01	DE83004135	MN -90a	8:11671
DOE/PC/40793-T5	NTIS, PC A05/MF A01	DE83004315	MN -90a	8:11672
DOE/PC/40796-4	NTIS, PC A02/MF A01	DE83002471	MN -90c	8:11767
DOE/PC/40799-T4	NTIS, PC A02/MF A01	DE83004577	MN -90d	8:11632
T5	NTIS, PC A03/MF A01	DE83004566	MN -90d	8:11673

Report No.	Availability	Order No.	Distribution Category	Abstract No.
DOE/PC/40800-T2	NTIS, PC A03/MF A01	DE83005235	MN -90d	8:11633
DOE/PC/40801-T5	NTIS, PC A02/MF A01	DE83003923	MN -90d	8:11636
DOE/PC/40807-T5	NTIS MF A01	DE83003860	MN -90i	8:11754
DOE/PC/40809-T4	NTIS, PC A03/MF A01	DE83004017	MN -90a	8:12750
DOE/PC/40812-T5	NTIS, PC A02/MF A01	DE83004313	MN -90d	8:11637
DOE/PC/41030-T1	NTIS, PC A09/MF A01	DE83003625	MN -90d	8:11638
DOE/PC/41760-T2	NTIS, PC A02/MF A01	DE83002808	MN -90d	8:11639
DOE/PC/41766-T1	NTIS MF A01	DE83005482	MN -90d	8:12751
DOE/PC/42295-T5	NTIS, PC A02/MF A01	DE83002234	MN -90b	8:11755
DOE/PC/42681-T1	NTIS, PC A04/MF A01	DE83005476	MN -90i	8:11691
DOE/PC/42682-T4	NTIS, PC A15/MF A01	DE83004817	MN -90i	8:11640
DOE/PC/50041-11	NTIS, PC A05/MF A01	DE83004847	STD -90d	8:11641
DOE/PC/50254-T1	NTIS, PC A05/MF A01	DE83004262	MN -90d	8:11642
DOE/PC/50783-1	NTIS, PC A02/MF A01	DE83004970	MN -90d	8:11643
DOE/PC/50798-1	NTIS, PC A02/MF A01	DE83004712	MN -90c	8:11644
DOE/PC/50816-1	NTIS, PC A03/MF A01	DE83004618	MN -90d	8:11645
DOE/PC/53030-T1	NTIS, PC A09/MF A01	DE83003045	STD -90d	8:11646
DOE/R5/10148-1	NTIS MF A01	DE83005506	MN -59	8:12154
DOE/R5/10247-1	NTIS, PC A02/MF A01	DE83004387	MN -95a	8:12622
DOE/R5/10252-2	NTIS MF A01	DE83005269	MN -59a	8:12155
DOE/R5/10311-2	NTIS MF A01	DE83004798	MN -97e	8:11996
DOE/R5/10314-2	NTIS MF A01	DE83003135	MN -95d	8:12156
DOE/R5/10316-T1	NTIS, PC A02/MF A01	DE83004579	MN -61a	8:12655
DOE/R5/10327-2	NTIS, PC A02/MF A01	DE83004797	ND -59a	8:12157
DOE/R5/10333-3	NTIS, PC A03/MF A01	DE83005109	MN -59a	8:12158
DOE/RA/23211-4	NTIS, PC A03/MF A01	DE83004753	STD -97e	8:11997
DOE/RA/50076-1	NTIS, PC A04/MF A01	DE83004875	MN -66g	8:12185
2	NTIS, PC A05/MF A01	DE83004876	MN -66i	8:12230
3	NTIS, PC A04/MF A01	DE83004877	MN -66i	8:12231
4	NTIS, PC A05/MF A01	DE83004878	MN -66i	8:12232
5	NTIS, PC A03/MF A01	DE83004879	MN -66i	8:12233
6	NTIS, PC A03/MF A01	DE83004880	MN -66i	8:12234
7	NTIS, PC A03/MF A01	DE83004882	MN -66i	8:12235
8	NTIS, PC A04/MF A01	DE83004881	MN -66i	8:12236
DOE/RA/50292-T1	NTIS, PC A03	DE83002492	ND -60	8:12263
DOE/RA/50298-T1-Bk.2	NTIS, PC A15/MF A01	DE83004781	ND -61a	8:11974
T1-Vol.1	NTIS, PC A05/MF A01	DE83004807	MN -61a	8:11975
T1-Vol.1-App.	NTIS, PC A09/MF A01	DE83004780	MN -61a	8:11976
T1-Vol.2	NTIS, PC A14/MF A01	DE83002204	MN -61a	8:11977
T1-Vol.3	NTIS, PC A07/MF A01	DE83004772	MN -61a	8:11978
T1-Vol.3-App.	NTIS, PC A14/MF A01	DE83004784	ND -61a	8:11979
T1-Vol.4	NTIS, PC A10/MF A01	DE83004773	MN -61a	8:11980
DOE/RA/50317-T1	NTIS, PC A08/MF A01	DE83004713	MN -61a	8:12051
DOE/RA/50320-T1	NTIS, PC A14/MF A01	DE83004714	MN -61a	8:12052
DOE/RA/50328-T1	NTIS, PC A05/MF A01	DE83004394	MN -61a	8:12053
DOE/RA/50338-1-Attach.B-Vol.3	NTIS, PC A07/MF A01	DE83001186	MN -61a	8:12016
1-Vol.1	NTIS, PC A08/MF A01	DE83001199	MN -61a	8:12054
DOE/RA/50353-T1-Vol.2	NTIS, PC A21	DE83003737	ND -61a	8:12055
DOE/RG/10076-T1	NTIS, PC A03/MF A01	DE83001913	MN -90j	8:12271

Report No.	Availability	Order No.	Distribution Category	Abstract No.
DOE/RG/10268-T2	NTIS, PC A07/MF A01	DE83004137	MN -80	8:12336
DOE/RG/10295-1	NTIS, PC A10/MF A01	DE83004443	MN -98E	8:12504
DOE/RG/10572-1	NTIS MF A01	DE83004445	MN -92	8:11811
3-Vol.1	NTIS MF A01	DE83004694	MN -92	8:11812
3-Vol.2	NTIS, PC A12	DE83004994	ND -92	8:11813
DOE/RL-82-4	NTIS, PC A03/MF A01	DE83004030	MN -41	8:13142
82-6	NTIS, PC A03/MF A01	DE83004028	MN -41	8:13143
82-7	NTIS, PC A02/MF A01	DE83004027	MN -41	8:13144
82-8	NTIS, PC A02/MF A01	DE83004026	MN -41	8:13145
82-9	NTIS, PC A02/MF A01	DE83004025	MN -41	8:13146
82-10	NTIS, PC A03/MF A01	DE83004024	MN -41	8:13147
82-11	NTIS, PC A03/MF A01	DE83004023	MN -41	8:13148
82-12	NTIS, PC A03/MF A01	DE83004063	MN -41	8:13149
82-13	NTIS, PC A02/MF A01	DE83004062	MN -41	8:13150
82-14	NTIS, PC A03/MF A01	DE83004074	MN -41	8:13151
DOE/SF/10499-46	NTIS, PC A03/MF A01	DE83001673	MN -62c	8:12120
DOE/SF/11429-1	NTIS, PC A14/MF A01	DE83004775	MN -66g	8:12056
DOE/SF/11525-T2	NTIS, PC A04/MF A01	DE83002537	STD -61d	8:12057
DOE/TIC-3386	NTIS, PC A99/MF A01	DE83006019	STD -32	8:13545
3386	NTIS, PC A99/MF A01	DE83006019	STD -32	8:13546
DOE/UMT-0212	NTIS, PC A03/MF A01	DE83005253	MN -70A	8:11922
DP-1640	NTIS, PC A04/MF A01	DE83003338	STD -70	8:11876
1645	NTIS, PC A04/MF A01	DE83004747	STD -70	8:11877
DP-MS-82-8	NTIS, PC A02/MF A01	DE83004931	MN -70	8:11878
82-21	NTIS, PC A03/MF A01	DE83004921	MN -25	8:12669
82-40	NTIS, PC A02/MF A01	DE83004928	MN -70	8:11879
82-42	NTIS, PC A02/MF A01	DE83002687	MN -70	8:11880
82-48	NTIS, PC A02/MF A01	DE83004918	MN -32	8:13547
82-49	NTIS, PC A03/MF A01	DE83004919	MN -23	8:11949
82-76	NTIS, PC A03/MF A01	DE83004924	MN -4	8:12752
DPSP-79-1003(Del.)	NTIS, PC A05/MF A01	DE83004821	MN -70	8:11881
DPSPU-82-30-3	NTIS, PC A02/MF A01; 1	DE83004927	MN -11	8:13038
DPST-81-141-4	*See* GJBX-25-82	DE82010053	MN -51	8:11829
82-128-2	NTIS, PC A04/MF A01	DE83004624	MN -23	8:11950
82-813	NTIS, PC A03/MF A01	DE83005043	MN -86	8:11951
82-839	NTIS, PC A02/MF A01	DE83005047	MN -23	8:11952
82-842	NTIS, PC A02/MF A01	DE83005045	MN -23	8:11953
82-854	NTIS, PC A02/MF A01	DE83005044	MN -23	8:11947
82-969	NTIS, PC A02/MF A01	DE83004926	MN -11	8:13096
ECN-81	NTIS (US Sales Only), PC A03/MF A01	DE83900847	MN -34C	8:13323
117	NTIS (US Sales Only), PC A04/MF A01	DE82703064	MN -32	8:13548
EGG-1183-1824	NTIS, PC A03/MF A01	DE83005109	STD -41	8:13064
1183-1837	NTIS, PC A02/MF A01	DE83005108	STD -41	8:13039
1183-5101	NTIS, PC A02/MF A01	DE83005875	MN -37	8:12846
2159	*See* NUREG/CR-2558	DE83900721	MN -78	8:12412
2191	*See* NUREG/CR-2701	DE83003925	MN -78	8:12414
EGG-FM-6046	NTIS, PC A02/MF A01	DE83003722	MN -38	8:12878
EGG-M-15682	NTIS, PC A02/MF A01	DE83003243	MN -38	8:12670
15782	NTIS, PC A02/MF A01	DE83003244	MN -38	8:12879
18582	NTIS, PC A02/MF A01	DE83003241	MN -78	8:12387
20482	NTIS, PC A02/MF A01	DE83003225	MN -78	8:12289
22482	NTIS, PC A02/MF A01	DE83003252	MN -90c	8:11647
22882	NTIS, PC A02/MF A01	DE83005276	MN -70B	8:11882
24282	NTIS, PC A02/MF A01	DE83003246	MN -80	8:12388
EGG-PHYS-5890	NTIS, PC A06/MF A01	DE83003721	MN -37	8:12948
6003	NTISMF $6.25	DE83003129	MN -80	8:12339
6145	NTIS, PC A03/MF A01	DE83005014	MN -11	8:13209
EGG-SD-5159	NTIS, PC A03/MF A01	DE83005518	MN -78	8:12389
EGG-TIO-M-02082	NTIS, PC A02/MF A01	DE83005274	MN -70	8:11883
EGG-WM-5792-Rev.1	NTIS, PC A03/MF A01	DE83003906	MN -15	8:11933
EIR-432	NTIS (US Sales Only), PC A03/MF A01	DE83900591	MN -78	8:12382

Report No.	Availability	Order No.	Distribution Category	Abstract No.
ELETROBRAS-CDTN-				
01/ 81	NTIS (US Sales Only), PC A04/MF A01	DE82703348	MN -78	8:12304
EPA-				
570/ 9-82-003	NTIS, PC A06/MF A01	DE83005166	MN -11	8:13084
EPRI-AF-				
1179-Vol.2	NTIS, PC A03/MF A01	DE83900895	MN -90c	8:11648
EPRI-EA-				
2639-SR	NTIS, PC A03/MF A01	DE83900733	MN -98E	8:12505
EPRI-EM-				
2351-Vol.4	NTIS, PC A09/MF A01	DE83004003	MN -94e	8:12449
EPRI-ER-				
1262	NTIS, PC A06/MF A01	DE83901087	MN -63	8:12546
EPRI-NP-				
1401-Vol.3	NTIS, PC A15/MF A01	DE83900753	MN -78	8:12390
2637	NTIS, PC A05/MF A01	DE83900639	MN -78	8:12831
2638	NTIS, PC A12/MF A01	DE83900741	MN -78	8:12305
2646	NTIS, PC A07/MF A01	DE83900740	MN -78	8:12391
2701	NTIS, PC A03/MF A01	DE83900751	MN -78	8:12306
2706	NTIS, PC A05/MF A01	DE83900752	MN -78	8:12307
EUR-				
7424	NTIS (US Sales Only), PC A06/MF A01	DE82703338	MN -80	8:12392
7427/ 1-EN	European Community Information Service, 2100 M Street, NW, Suite 707, Washington, DC		ND -38	8:12868
7427(pt.1)	NTIS (US Sales Only), PC A04/MF A01	DE82703393	MN -32	8:13248
7441	NTIS (US Sales Only), PC A04/MF A01	DE83780178	MN -70	8:11887
7443	NTIS (US Sales Only), PC A04/MF A01	DE82703328	MN -25	8:12949
7575	NTIS (US Sales Only), PC A12/MF A01	DE82703345	MN -78	8:12290
7580	NTIS (US Sales Only), PC A03/MF A01	DE82703387	MN -16	8:11934
7580-EN	European Community Information Service, 2100 M Street, N.W., Suite 707, Washington, DC 20037		ND -15	8:11935
7641-FR	European Community Information Service, 2100 M Street, NW, Suite 707, Washington, DC 20037		ND -13	8:12461
7680-EN	European Community Information Service, 2100 M Street NW, Suite 707, Washington, DC 20037		ND -61c	8:13127
8129-EN	Commission of the European Communities, 2100 M Street, NW, Washington, DC 20037		ND -32	8:12481
8148-EN	European Community Information Service, 2100 M Street, NW, Suite 707, Washington, DC		ND -63c	8:12058
8150-EN	European Community Information Service, 2100 M Street NW, Suite 707, Washington, DC 20037		ND -63d	8:12059
8164-EN	European Community Information Service, 2100 M Street, N.W., Suite 707, Washington, DC 20037		ND -59	8:12159
8188/ 1-EN	Commission of the European Communities, 2100 M. Street, NW, Washington, DC 20037		ND -32	8:13097
8188/ 2-EN	Commission of the European Communities, 2100 M Street, NW, Washington, DC 20037		ND -32	8:13098
8208-EN	European Community Information Service, 2100 M Street, NW, Suite 707, Washington, DC		ND -63c	8:12060
FE-				
2494-FR-3	*See* DOE/ET/10587-T1-Pt.3	DE83004597	STD -90d	8:11613
2893-96	*See* DOE/ET/10069-T21	DE83001390	STD -90d	8:11599
FEI-				
1241	NTIS (US Sales Only), PC A02/MF A01	DE82703394	MN -32	8:13549
FERMILAB-CONF-				
82/ 67-THY	NTIS, PC A03/MF A01	DE83004065	MN -34D	8:13405
82/ 69-EXP	NTIS, PC A02/MF A01	DE83002100	MN -34D	8:13258
82/ 86	NTIS MF A01	DE83004509	MN -34D	8:13276
82/ 87	NTIS, PC A02/MF A01	DE83004464	MN -34D	8:13259
82/ 97-EXP	NTIS, PC A02/MF A01	DE83004392	MN -34D	8:13260
FERMILAB/TM-				
1148	NTIS MF A01	DE83004555	MN -28	8:12917
FRCR-				
250	*See* DOE/ET/53042-13	DE83000160	MN -20f	8:13475
FRNC-TH-				
1063	NTIS (US Sales Only), PC A08/MF A01	DE83780188	MN -34D	8:13261
FS-				
79-19-AKD	NTIS (US Sales Only), PC A07/MF A01	DE83780191	MN -41	8:12963
FWS/OBS-				
80/ 46.1	Fish and Wildlife Service, Washington, DC 20240		MN -11	8:13068
80/ 46.2	Fish and Wildlife Service, Washington, DC 20240		MN -11	8:13053
80/ 47.1	Fish and Wildlife Service, Washington, DC 20240		MN -11	8:13054
80/ 47.2	Fish and Wildlife Service, Washington, DC 20240		MN -11	8:13069
80/ 48.1	Fish and Wildlife Service, Washington, DC 20240		MN -11	8:13070
80/ 48.2	Fish and Wildlife Service, Washington, DC		MN -11	8:13071
81/ 49	Fish and Wildlife Service, Washington, DC 20240		MN -48	8:13055
GA-A-				
16748	NTIS, PC A02/MF A01	DE83003218	MN -20e	8:13476
16784	NTIS, PC A02/MF A01	DE83003213	MN -20a	8:13477
16848	NTIS, PC A03/MF A01	DE83005154	STD -20g	8:13478
16885	NTIS, PC A02/MF A01	DE83004679	MN -20c	8:13479
GAO/EMD-				
82-90	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		MN -78	8:12393
82-104	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		MN -13	8:12488

Report No.	Availability	Order No.	Distribution Category	Abstract No.
82-105	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		MN -97c	8:12506
GAO/ID-				
82-21	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		MN -15	8:11936
GEAP-				
22077	NTIS, PC A05/MF A01	DE83004455	STD -78	8:12291
22211	NTIS, PC A07/MF A01	DE83003975	STD -78	8:12292
24381	NTIS (US Sales Only), PC A04/MF A01	DE83004456	STD -78	8:12293
GEND-				
012	NTIS, PC A02/MF A01	DE83002733	STD -78	8:12394
GEPP-TIS-				
696	NTIS, PC A03/MF A01	DE83003426	MN -13	8:12451
GFETC/IC-				
82/ 1	NTIS, PC A99/MF A01	DE82015926	STD -90	8:11718
GJBX-				
21-82	NTIS MF A01	DE82007138	MN -51	8:11827
24-82	NTIS MF A01	DE82007139	MN -51	8:11828
25-82	NTIS, PC A03/MF A01	DE82010053	MN -51	8:11829
165-82	NTIS MF A01	DE83004487	MN -51	8:11830
166-82	NTIS, PC A04/MF A01	DE83004486	MN -51	8:11831
167-82	NTIS MF A01	DE83004484	MN -51	8:11832
169-82	NTIS, PC A04/MF A01	DE83003513	MN -51	8:11833
170-82	NTIS MF A01	DE83004554	MN -51	8:11834
172-82	NTIS MF A01	DE83004482	MN -51	8:11835
173-82	NTIS MF A01	DE83004529	MN -51	8:11836
177-82	NTIS, PC A04	DE83004564	ND -51	8:11837
196-82-Vol.1	NTIS PC E09/MF $12.00	DE83003409	MN -51	8:11838
196-82-Vol.2A	NTIS, PC A99/MF A01	DE83002700	MN -51	8:11839
196-82-Vol.2B	NTIS MF A01	DE83002701	MN -51	8:11840
196-82-Vol.2C	NTIS, PC A14/MF A01	DE83002726	MN -51	8:11841
196-82-Vol.2D	NTIS, PC A23/MF A01	DE83002724	MN -51	8:11842
GKSS-				
82/ E/ 4	NTIS (US Sales Only), PC A06/MF A01	DE82750933	MN -34D	8:13415
GRS-A-				
658	Gesellschaft fuer Reaktorsicherheit, Glockengasse 2 . 5000, Koeln, Germany		ND -79p	8:12395
661	Gesellschaft fuer Reaktorsicherheit, Forschungsgelaende, 8046 Garching, Germany		ND -78	8:12396
666	Gesellschaft fuer Reaktorsicherheit (GRS)mbH, Garching, Germany		ND -78	8:12397
GTFR-				
36	NTIS MF A01	DE83002778	MN -20	8:13480
GTR-				
2913	NTIS, PC A04/MF A01	DE83005215	STD -90f	8:12276
HEDL-SA-				
2692-FP	NTIS, PC A02/MF A01	DE83004071	MN -20c	8:13481
2719	NTIS, PC A02/MF A01	DE83004072	MN -79b	8:12370
2729S	NTIS, PC A02/MF A01	DE83004506	MN -20d	8:13482
2747	NTIS, PC A03/MF A01	DE83004505	MN -20d	8:13483
2765-FP	NTIS, PC A02/MF A01	DE83004068	MN -15	8:11937
2790	NTIS, PC A03/MF A01	DE83004073	MN -78	8:12398
IAE-				
3376/ 5	NTIS (US Sales Only), PC A03/MF A01	DE82703333	MN -80	8:12340
IAEA-NDS-				
7(Rev.1)	NTIS (US Sales Only), PC A02/MF A01	DE82703062	MN -2	8:13571
22	NTIS (US Sales Only), PC A02/MF A01	DE82703061	MN -2	8:13296
IFUSP-P-				
266	NTIS (US Sales Only), PC A07/MF A01	DE82703378	MN -2	8:12468
296	NTIS (US Sales Only), PC A04/MF A01	DE82703379	MN -2	8:12489
IFVE-OEA-				
81-170	NTIS (US Sales Only), PC A02/MF A01	DE82703395	MN -32	8:12918
IFVE-OMVT/OUNK-				
81-121	NTIS (US Sales Only), PC A02/MF A01	DE82703396	MN -32	8:12847
IITRI-M-				
06087-D	NTIS, PC A05/MF A01	DE83005471	MN -90h	8:11651
INFN/AE-				
82/ 3	NTIS (US Sales Only), PC A02/MF A01	DE83900836	MN -34	8:13406
82/ 4	NTIS (US Sales Only), PC A02/MF A01	DE83900837	MN -34	8:13277
INFN/BE-				
82/ 1	NTIS (US Sales Only), PC A03/MF A01	DE83900841	MN -34	8:13303
INFN/TC-				
82/ 8	NTIS (US Sales Only), PC A02/MF A01	DE83900840	MN -28	8:12919
INFO-				
0051	NTIS (US Sales Only), PC A02/MF A01	DE82703382	MN -41	8:12325
0052	NTIS (US Sales Only), PC A02/MF A01	DE82703383	MN -2	8:12399
0054	NTIS (US Sales Only), PC A02/MF A01	DE82703384	MN -2	8:12326
0055	NTIS (US Sales Only), PC A02/MF A01	DE82703385	MN -2	8:12327
0056	NTIS (US Sales Only), PC A02/MF A01	DE82703344	MN -80	8:12400
0059	NTIS (US Sales Only), PC A02/MF A01	DE82703386	MN -41	8:12365
INIS-mf-				
7038	NTIS (US Sales Only), PC A02/MF A01	DE82780782	MN -2	8:12401
7218	NTIS (US Sales Only), PC A02/MF A01	DE83780218	MN -4	8:13104
7220	NTIS (US Sales Only), PC A03/MF A01	DE83780084	MN -34A	8:13223
7221	NTIS (US Sales Only), PC A05/MF A01	DE83780081	MN -34D	8:13224

Report No.	Availability	Order No.	Distribution Category	Abstract No.
7224	NTIS (US Sales Only), PC A09/MF A01	DE83780197	MN -11	8:13087
7225	NTIS (US Sales Only), PC A09/MF A01	DE83780237	MN -23	8:11945
7423	NTIS (US Sales Only), PC A10/MF A01	DE83780179	MN -34D	8:13416
7424	NTIS (US Sales Only), PC A07/MF A01	DE83780190	MN -34C	8:12964
7431	NTIS (US Sales Only), PC A02/MF A01	DE83780180	MN -34D	8:13282
7432	NTIS (US Sales Only), PC A06/MF A01	DE83780216	MN -34A	8:13225
7433	NTIS (US Sales Only), PC A02/MF A01	DE83780184	MN -20	8:13424
7434	NTIS (US Sales Only), PC A03/MF A01	DE83780185	MN -20	8:13429
7454	NTIS (US Sales Only), PC A05/MF A01	DE83780186	MN -20	8:13433
7457	NTIS (US Sales Only), PC A08/MF A01	DE83780187	MN -20	8:13434
7461	NTIS (US Sales Only), PC A05/MF A01	DE83780182	MN -34A	8:12781
7463	NTIS (US Sales Only), PC A14/MF A01	DE83780183	MN -34A	8:12710
7501	NTIS (US Sales Only), PC A06/MF A01	DE83780119	MN -4	8:12753
INIS-SU-				
104	NTIS (US Sales Only), PC A16/MF A01	DE83780217	MN -20	8:13435
115	NTIS (US Sales Only), PC A14/MF A01	DE83780082	MN -34A	8:13238
119	NTIS (US Sales Only), PC A07/MF A01	DE83780227	MN -34D	8:13251
120	NTIS (US Sales Only), PC A11/MF A01	DE83780123	MN -4	8:12806
121	NTIS (US Sales Only), PC A12/MF A01	DE83780238	MN -4	8:11981
126	NTIS (US Sales Only), PC A12/MF A01	DE83780192	MN -4	8:12745
IPEN-Inf-				
08	NTIS (US Sales Only), PC A02/MF A01	DE82703341	MN -80	8:12356
09	NTIS (US Sales Only), PC A02/MF A01	DE82703342	MN -80	8:12357
IPEN-Pub-				
31	NTIS (US Sales Only), PC A02/MF A01	DE82703360	MN -37	8:12965
32	NTIS (US Sales Only), PC A02/MF A01	DE82703361	MN -37	8:12966
40	NTIS (US Sales Only), PC A02/MF A01	DE83900844	MN -37	8:12967
IPNO-				
81-04	NTIS (US Sales Only), PC A02/MF A01	DE82703363	MN -37	8:12968
IPNO-RC-				
81-08	NTIS (US Sales Only), PC A03/MF A01	DE82703364	MN -37	8:12969
IPP-				
4/ 205	NTIS (US Sales Only), PC A03/MF A01	DE82750937	MN -20a	8:13436
IS-M-				
384	NTIS, PC A03/MF A01	DE83003791	MN -25	8:12402
388	NTIS, PC A02/MF A01	DE83003793	MN -4	8:12783
389	NTIS, PC A03/MF A01	DE83003792	MN -4	8:12784
390	NTIS, PC A02/MF A01	DE83003790	MN -38	8:12880
IS-RIC-PR-				
3	NTIS, PC A07/MF A01	DE83003815	MN -25	8:12673
IS-T-				
912	NTIS, PC A03/MF A01	DE83004938	MN -25	8:12674
951	NTIS, PC A08/MF A01	DE83004986	MN -25	8:12711
959	NTIS, PC A06/MF A01	DE83004971	MN -4	8:12785
963	NTIS, PC A07/MF A01	DE83004982	MN -4	8:12737
964	NTIS, PC A06/MF A01	DE83004864	MN -4	8:12786
965	NTIS, PC A07/MF A01	DE83004985	MN -4	8:12754
983	NTIS, PC A07/MF A01	DE83004983	MN -34D	8:13263
988	NTIS, PC A11/MF A01	DE83004960	MN -4	8:12755
989	NTIS, PC A05/MF A01	DE83004972	MN -90a	8:11677
990	NTIS, PC A06/MF A01	DE83004968	MN -90a	8:11678
993	NTIS, PC A06/MF A01	DE83004980	MN -25	8:12675
994	NTIS, PC A07/MF A01	DE83004984	MN -4	8:12756
998	NTIS, PC A05/MF A01	DE83004976	MN -25	8:12712
1000	NTIS, PC A04/MF A01	DE83004964	MN -25	8:12676
1004	NTIS, PC A07/MF A01	DE83004959	MN -4	8:12823
1006	NTIS, PC A05/MF A01	DE83004975	MN -4	8:11652
1007	NTIS, PC A06/MF A01	DE83004963	MN -4	8:12787
1009	NTIS, PC A11/MF A01	DE83004967	MN -4	8:12815
1011	NTIS, PC A06/MF A01	DE83004973	MN -4	8:11982
1012	NTIS, PC A05/MF A01	DE83005004	MN -34D	8:13312
1014	NTIS, PC A04/MF A01	DE83004793	MN -32	8:13417
1017	NTIS, PC A04/MF A01	DE83004979	MN -34D	8:13278
1018	NTIS, PC A04/MF A01	DE83004978	MN -4	8:12738
1019	NTIS, PC A11/MF A01	DE83004958	MN -34	8:12739
1020	NTIS, PC A04/MF A01	DE83004981	MN -61a	8:12061
1022	NTIS, PC A05/MF A01	DE83004977	MN -90a	8:11757
1023	NTIS, PC A08/MF A01	DE83004965	MN -4	8:12757
1025	NTIS, PC A03/MF A01	DE83004867	MN -32	8:13403
1026	NTIS, PC A07/MF A01	DE83004855	MN -25	8:12677
1027	NTIS, PC A05/MF A01	DE83004866	MN -34	8:12678
1028	NTIS, PC A07/MF A01	DE83004854	MN -94cc	8:12679
1030	NTIS, PC A05/MF A01	DE83004796	MN -34A	8:12713
1031	NTIS, PC A08/MF A01	DE83004865	MN -4	8:12788
1032	NTIS, PC A05/MF A01	DE83004788	MN -61c	8:12807
1034	NTIS, PC A07/MF A01	DE83004856	MN -4	8:12789
1035	NTIS, PC A09/MF A01	DE83004795	MN -4	8:12790
1036	NTIS, PC A05/MF A01	DE83004861	MN -25	8:12791
1037	NTIS, PC A05/MF A01	DE83004792	MN -34A	8:12680
1039	NTIS, PC A06/MF A01	DE83004794	MN -34	8:12714
1040	NTIS, PC A05/MF A01	DE83004786	MN -25	8:12681
1045	NTIS, PC A06/MF A01	DE83004789	MN -61c	8:12062
1048	NTIS, PC A07/MF A01	DE83004790	MN -4	8:12758
1049	NTIS, PC A03/MF A01	DE83004787	MN -25	8:12682

Report No.	Availability	Order No.	Distribution Category	Abstract No.
ISPO-				
157	*See* MLM-3009	DE83901008	STD -15	8:11940
ITEF-				
102(1981)	NTIS (US Sales Only), PC A02/MF A01	DE82703316	MN -28	8:12900
106(1981)	NTIS (US Sales Only), PC A02/MF A01	DE82703334	MN -80	8:12341
107(1981)	NTIS (US Sales Only), PC A02/MF A01	DE82703317	MN -28	8:12901
JHU-HET-				
8213	*See* DOE/ER/03285-44	DE83005268	MN -34D	8:13286
JINR-				
9-81-682	NTIS (US Sales Only), PC A02/MF A01	DE82703318	MN -28	8:12920
13-81-727	NTIS (US Sales Only), PC A02/MF A01	DE82703365	MN -37	8:12970
13-81-782	NTIS (US Sales Only), PC A02/MF A01	DE82703366	MN -37	8:12921
JINR-R-				
9-81-639	NTIS (US Sales Only), PC A02/MF A01	DE82703320	MN -28	8:12922
9-81-664	NTIS (US Sales Only), PC A02/MF A01	DE82703321	MN -28	8:12902
9-81-685	NTIS (US Sales Only), PC A02/MF A01	DE82703322	MN -28	8:12923
9-81-712	NTIS (US Sales Only), PC A02/MF A01	DE82703323	MN -28	8:13377
9-81-734	NTIS (US Sales Only), PC A02/MF A01	DE82703324	MN -28	8:12895
9-81-809	NTIS (US Sales Only), PC A02/MF A01	DE82703325	MN -28	8:12903
11-81-813	NTIS (US Sales Only), PC A02/MF A01	DE82703319	MN -28	8:12904
JPL-PUB-				
82-14	*See* DOE/ET/12548-15	DE83005143	STD -88	8:11717
82-31	*See* DOE/ET/12548-13	DE83005137	STD -88	8:11716
82-91	*See* DOE/CS/54209-10	DE83003283	STD -96	8:12459
82-94	*See* DOE/JPL-1060-56	DE83005140	STD -62b	8:12179
82-98	*See* DOE/ER/10614-2	DE83005138	STD -66d	8:12240
82-101	*See* DOE/ET/20356-7	DE83005142	STD -63	8:12012
Juel-				
1737	NTIS (US Sales Only), PC A04/MF A01	DE82750922	MN -25	8:11957
Juel-Conf-				
42-Vol.2	NTIS (US Sales Only), PC A21/MF A01	DE82905800	MN -70	8:11688
K/TD-				
409	NTIS, PC A02/MF A01	DE83004199	MN -22	8:12474
K/UR-				
402	*See* GJBX-21-82	DE82007138	MN -51	8:11827
407	*See* GJBX-24-82	DE82007139	MN -51	8:11828
445	*See* GJBX-165-82	DE83004487	MN -51	8:11830
446	*See* GJBX-166-82	DE83004486	MN -51	8:11831
447	*See* GJBX-167-82	DE83004484	MN -51	8:11832
450	*See* GJBX-170-82	DE83004554	MN -51	8:11834
452	*See* GJBX-172-82	DE83004482	MN -51	8:11835
453	*See* GJBX-173-82	DE83004529	MN -51	8:11836
457	*See* GJBX-177-82	DE83004564	ND -51	8:11837
458	*See* GJBX-169-82	DE83003513	MN -51	8:11833
KAPL-				
4135	NTIS, PC A03/MF A01	DE83004431	MN -25	8:12683
KFK-				
3074	NTIS (US Sales Only), PC A03/MF A01	DE82750928	MN -11	8:13088
3209	NTIS (US Sales Only), PC A02/MF A01	DE82750932	MN -11	8:13040
3227B	NTIS (US Sales Only), PC A05/MF A01	DE82750931	MN -41	8:13041
3240	NTIS (US Sales Only), PC A02/MF A01	DE82750936	MN -38	8:12848
3287	NTIS (US Sales Only), PC A09/MF A01	DE82750920	MN -90b	8:12849
3291	NTIS (US Sales Only), PC A03/MF A01	DE82750942	MN -80	8:12287
3292	NTIS (US Sales Only), PC A03/MF A01	DE82750943	MN -80	8:12403
3301	NTIS (US Sales Only), PC A03/MF A01	DE82750929	MN -70	8:11889
3309	NTIS (US Sales Only), PC A02/MF A01	DE82750941	MN -25	8:11938
3318	NTIS (US Sales Only), PC A04/MF A01	DE82750935	MN -80	8:12869
3327	NTIS (US Sales Only), PC A06/MF A01	DE82750930	MN -34D	8:13229
3332	NTIS (US Sales Only), PC A03/MF A01	DE82750923	MN -22	8:11843
KFK-tr-				
673	NTIS (US Sales Only), PC A02/MF A01	DE83900590	MN -28	8:12827
KFTI-				
81-40	NTIS (US Sales Only), PC A03/MF A01	DE82703367	MN -37	8:12924
KMSF-U-				
1266	NTIS, PC A02/MF A01	DE82020324	MN -21	8:11944
LA-				
9329-MS	NTIS, PC A07/MF A01	DE83003891	STD -70	8:11923
9445-PNTX-B	NTIS, PC A02/MF A01	DE83004950	MN -11	8:13074
9466-MS	NTIS, PC A02/MF A01	DE83003996	STD -38	8:12850
9536-MS	*See* NUREG/CR-2966	DE83005348	MN -78	8:12352
9539-MS	NTIS MF A01	DE83003890	STD -41	8:13136
9544-M	NTIS, PC A02/MF A01	DE83003999	STD -15	8:11939
9559-MS	NTIS, PC A02/MF A01	DE83003896	STD -34	8:12723
9564-MS	NTIS, PC A02/MF A01	DE83004996	STD -34	8:12724
9566-MS	NTIS, PC A02/MF A01	DE83004995	STD -34D	8:13264
9570-MS	NTIS, PC A02/MF A01	DE83003997	STD -28	8:12905
9601-MS	NTIS, PC A02/MF A01	DE83005604	STD -11	8:13022
9604-MS	NTIS, PC A02/MF A01	DE83005601	STD -15	8:13334
LA-tr-				
82-28	NTIS, PC A02/MF A01	DE83001241	MN -34	8:12898
83-1	NTIS, PC A02/MF A01	DE83005025	MN -38	8:12890
83-2	NTIS, PC A02/MF A01	DE83005024	MN -38	8:12889
LA-UR-				
82-870	NTIS, PC A02/MF A01	DE82012152	MN -59	8:12160
82-3267	NTIS, PC A02/MF A01	DE83003565	MN -28	8:12906

Report No.	Availability	Order No.	Distribution Category	Abstract No.
82-3279	NTIS, PC A03/MF A01	DE83003542	MN -33	8:12322
82-3289	NTIS, PC A02/MF A01	DE83003568	MN -20d	8:13437
82-3290	NTIS, PC A02/MF A01	DE83003569	MN -20d	8:13438
82-3317	NTIS, PC A02/MF A01	DE83003575	MN -20f	8:13439
82-3322	NTIS, PC A02/MF A01	DE83003539	MN -32	8:13550
82-3323	NTIS, PC A02/MF A01	DE83003540	MN -20f	8:13440
82-3324	NTIS, PC A02/MF A01	DE83003537	MN -20f	8:13441
82-3328	NTIS, PC A02/MF A01	DE83003536	MN -21	8:13485
82-3330	NTIS, PC A02/MF A01	DE83003535	MN -37	8:12971
82-3334	NTIS, PC A02/MF A01	DE83003534	MN -32	8:13551
82-3338	NTIS, PC A02/MF A01	DE83003638	MN -34D	8:13407
82-3380	NTIS, PC A02/MF A01	DE83003533	MN -20g	8:13442
82-3398	NTIS, PC A02/MF A01	DE83003560	MN -32	8:13552
82-3483	NTIS, PC A02/MF A01	DE83004727	MN -11	8:11927
82-3488	NTIS, PC A02/MF A01	DE83004728	MN -11	8:13042
82-3489	NTIS, PC A02/MF A01	DE83004729	MN -11	8:13028
82-3500	NTIS, PC A02/MF A01	DE83004730	MN -11	8:13065
82-3525	NTIS, PC A02/MF A01	DE83004731	MN -59c	8:12161
82-3550	NTIS, PC A02/MF A01	DE83004732	MN -32	8:13553
82-3557	NTIS, PC A02/MF A01	DE83004733	MN -4	8:12824
82-3563	NTIS, PC A02/MF A01	DE83004734	MN -25	8:12684
82-3566	NTIS, PC A02/MF A01	DE83004735	MN -61a	8:12063
82-3578	NTIS, PC A02/MF A01	DE83004737	MN -34B	8:13230
82-3584	NTIS, PC A02/MF A01	DE83004808	MN -66b	8:12245
82-3596	NTIS, PC A02/MF A01	DE83004810	MN -34B	8:13231
82-3621	NTIS, PC A02/MF A01	DE83004740	MN -28	8:12865
82-3634	NTIS, PC A02/MF A01	DE83004741	MN -59c	8:12162
82-3641	NTIS, PC A02/MF A01	DE83004742	MN -11	8:13218
82-3657	NTIS, PC A02/MF A01	DE83004743	MN -32	8:13554
82-3658	NTIS, PC A02/MF A01	DE83004744	MN -48	8:13152
82-3681	NTIS, PC A02/MF A01	DE83004746	MN -11	8:13043
82-3682	NTIS, PC A03/MF A01	DE83004812	MN -66c	8:12246
LALP-				
82-34	NTIS, PC A02/MF A01	DE83004319	MN -38	8:12851
LAPP-				
81-04	NTIS (US Sales Only), PC A05/MF A01	DE82703368	MN -37	8:12972
LBL-				
7520-Rev.	NTIS, PC A02/MF A01	DE83004189	MN -48	8:13183
12811	NTIS, PC A99/MF A01	DE83003978	MN -34D	8:13335
13840	NTIS, PC A15/MF A01	DE83004059	STD -13	8:13535
14234	NTIS, PC A03/MF A01	DE83003986	MN -48	8:13138
14325	*See* ONWI-399	DE83005249	MN -70	8:12825
14456	NTIS, PC A02/MF A01	DE83004193	MN -37	8:12973
14464	NTIS, PC A02/MF A01	DE83004117	MN -20c	8:13443
14471	NTIS, PC A02/MF A01	DE83003984	MN -32	8:13555
14623	NTIS, PC A02/MF A01	DE83004191	MN -28	8:12925
14624	NTIS, PC A02/MF A01	DE83004192	MN -28	8:12896
14766	NTIS MF A01	DE83004158	MN -34A	8:12685
14859	NTIS, PC A06/MF A01	DE83005122	STD -38	8:12852
14916	NTIS, PC A02/MF A01	DE83004181	MN -38	8:12974
14980	NTIS, PC A02/MF A01	DE83004190	MN -34C	8:13297
15071	NTIS MF A01	DE83004116	MN -34C	8:13265
15073	NTIS, PC A06/MF A01	DE83004467	STD -66b	8:12201
15089	NTIS, PC A02/MF A01	DE83003759	MN -28	8:12907
15156	NTIS, PC A02/MF A01	DE83004295	MN -4	8:12792
15220	NTIS, PC A02/MF A01	DE83004182	MN -25	8:13404
15225	NTIS MF A01	DE83004270	MN -34D	8:12897
15244	NTIS, PC A06/MF A01	DE83004241	MN -34D	8:13289
15251	NTIS, PC A02/MF A01	DE83004466	STD -95d	8:12561
15252	NTIS, PC A03/MF A01	DE83004465	STD -95d	8:12562
LCC-				
010/ 81	NTIS (US Sales Only), PC A02/MF A01	DE82703390	MN -32	8:13556
017/ 81	NTIS (US Sales Only), PC A02/MF A01	DE82703339	MN -80	8:12853
LMF-				
97	*See* NUREG/CR-2832	DE83900893	MN -41	8:11928
LMSC-D-				
812950-Vol.1-Pt.1	*See* NUREG/CR-2836-Vol.1-Pt.1	DE83901035	MN -80	8:12350
812950-Vol.1-Pt.2	*See* NUREG/CR-2836-Vol.1-Pt.2	DE83901036	MN -80	8:12296
LYCEN-				
8134	NTIS (US Sales Only), PC A05/MF A01	DE82703326	MN -28	8:12926
8149	NTIS (US Sales Only), PC A05/MF A01	DE82703369	MN -37	8:12927
MAI-				
213	*See* PB-82-260100			8:12165
MDC-G-				
8250	*See* DOE/SF/10499-46	DE83001673	MN -62c	8:12120
8544-Vol.2	*See* CAPE-2770	DE83001837		8:12128
8544-Vol.3	NTIS MF A01		MN -62c	8:12121
9704	*See* CAPE-2771	DE83001809		8:12127
MDC-Q-				
0775	*See* UCRL-15512	DE83004218	MN -34A	8:12726
MHSMP-				
82-41	NTIS, PC A03/MF A01	DE83005031	MN -35	8:13009
82-47	NTIS, PC A02/MF A01	DE83004947	MN -35	8:13010
MIT/EL-				
81-031	NTIS, PC A07/MF A01	DE83002753	MN -98E	8:12507

Report No.	Availability	Order No.	Distribution Category	Abstract No.
MLM-				
3009	NTIS, PC A05/MF A01	DE83901008	STD -15	8:11940
3028	NTIS, PC A04/MF A01	DE83003803	STD -70	8:11890
3029	NTIS, PC A02/MF A01	DE83003224	STD -20d	8:13486
MTCH-PR-				
7-79	NTIS, PC A04/MF A01	DE83005503	STD -88	8:11737
MTR-				
80W215-02	NTIS, PC A10/MF A01	DE83004890	MN -58b	8:12019
80W215-03	NTIS, PC A05/MF A01	DE83004452	MN -58b	8:12020
82W59	NTIS, PC A05/MF A01	DE83005048	MN -58b	8:12021
NASA-CR-				
168020	*See* DOE/NASA-0241-5	DE83005613	MN -93	8:12522
NASA-TM-				
83025	*See* DOE/NASA/10769-28	DE83003670	STD -90g	8:12516
83035	*See* DOE/NASA/20485-13	DE83005103	STD -63	8:12015
NBSIR-				
82-2552	NTIS, PC A04/MF A01	DE82021026	MN -97a	8:12885
NCSC-TM-				
295-80	*See* DOE/CH/00135-4	DE83005840	MN -64	8:12131
296-80	*See* DOE/CH/00135-1	DE83005846	MN -64	8:12129
297-80	*See* DOE/CH/00135-2	DE83005844	MN -64	8:12130
NDRE/PUBL-				
81/ 1003	NTIS (US Sales Only), PC A05/MF A01	DE83900184	MN -94cc	8:12813
NGD-				
12-1981-R-O	NTIS (US Sales Only), PC A03/MF A01	DE83900710	MN -98F	8:12475
NIIEFA-P-FD-				
0531	NTIS (US Sales Only), PC A03/MF A01	DE82703327	MN -28	8:12928
NP-				
24380	NTIS (US Sales Only), PC A02/MF A01	DE83901085	MN -90	8:11787
25147	NTIS (US Sales Only), PC A02/MF A01	DE83901086	MN -61a	8:12064
3900369	NTIS (US Sales Only), PC A03/MF A01	DE83900369	MN -2	8:13533
3900697	Colorado Div. of Mines, 1313 Sherman St., Room 718, Denver, CO 80203		MN -98A	8:11784
3900842	NTIS (US Sales Only), PC A07/MF A01	DE83900842	MN -13	8:12929
3900855	NTIS (US Sales Only), PC A05/MF A01	DE83900855	MN -25	8:12658
3900856	NTIS (US Sales Only), PC A06/MF A01	DE83900856	MN -34	8:13226
3900898	California Energy Commission, 1516 Ninth Street, Sacramento, CA 95814		MN -58d	8:12022
3900959	Wyoming Geological Survey, P.O. Box 3008, University Station, Laramie, WY 82071		MN -92a	8:11791
3900964	NTIS MF A01	DE83900964	MN -59	8:12163
3900983	Wyoming Geological Survey, P.O. Box 3008, University Station, Laramie, WY 82071		MN -92	8:11788
3901050	NTIS, PC A02/MF A01	DE83901050	MN -13	8:13072
3901068	Dept. of Commerce, Law Bldg., 4th Fl., P.O. Box 30004, Lansing, MI		MN -98	8:12482
3901074	NTIS, PC A21/MF A01	DE83901074	MN -11	8:13101
3901076	Wyoming Geological Survey, P.O. Box 3008, University Station, Laramie, WY 82071		MN -51	8:11826
3901078	Kansas State Water Resources Research Inst., Manhattan		MN -90i	8:11692
3901079	NTIS, PC A04/MF A01	DE83901079	MN -11	8:13029
NP-tr-				
3900401	NTIS (US Sales Only)	DE83900401	MN -98C	8:11822
3900765	NTIS (US Sales Only), PC A02/MF A01	DE83900765	MN -92	8:11991
3900768	NTIS (US Sales Only)MF A01		MN -92	8:11823
3900769	NTIS (US Sales Only), PC A02/MF A01	DE83900769	MN -92a	8:12893
NRL-MR-				
4947	NTIS, PC A02/MF A01	DE83005115	MN -21	8:13487
4985	NTIS, PC A02/MF A01	DE83005104	STD -20g	8:13488
NRPB-IE-				
21	NTIS (US Sales Only), PC A02/MF A01	DE82703370	MN -37	8:12975
NUCLEBRAS-CDTN-				
434/ 81	NTIS (US Sales Only), PC A02/MF A01	DE82703343	MN -80	8:12358
NUREG-				
0011-Suppl.6	NTIS, PC A03/MF A01 - GPO $4.75	DE83900976	MN -78	8:12404
0139-Suppl.1-Vol.1	NTIS, PC A14/MF A01 - GPO $8.50	DE83900709	MN -79	8:12366
0540-Vol.4-No.8	NTIS, PC A25/MF A01 - GPO	DE83900979	MN -2	8:12328
0606-Vol.4-No.4	NTIS, PC A05/MF A01 - GPO	DE83900592	MN -80	8:12405
0750-Vol.15-No.6	NTIS, PC A18/MF A01 - GPO	DE83900459	MN -2	8:12329
0783	NTIS, PC A03/MF A01 - GPO $3.00	DE83900908	MN -78	8:12406
0820	NTIS MF A01- GPO $12.00	DE83900458	MN -78	8:12407
0837-Vol.2-No.2	NTIS, PC A09/MF A01 - GPO $7.50	DE83900891	MN -41	8:12367
0871-Vol.1-No.4	NTIS, PC A03/MF A01 - GPO	DE83900778	MN -80	8:12330
0892-Suppl.2	NTIS, PC A03/MF A01 - GPO $4.50	DE83900926	MN -78	8:12331
0912	NTIS, PC A04/MF A01 - GPO $5.00	DE83900707	MN -80	8:12408
0952	NTIS, PC A20/MF A01 - GPO $11.00	DE83900030	MN -78	8:12308
NUREG/BR-				
0051-Vol.4-No.4	NTIS, PC A03/MF A01 - GPO	DE82905921	MN -78	8:12409
NUREG/CR-				
1935	NTIS, PC A03/MF A01 - GPO	DE83003698	MN -32	8:13557
2000-Vol.1-No.11	NTIS, PC A06/MF A01 - GPO $6.00	DE83004686	MN -80	8:12410
2317-Vol.2-No.1	NTIS, PC A03/MF A01 - GPO	DE83002110	MN -70	8:12686
2423	NTIS, PC A04/MF A01 - GPO $5.00	DE83004572	MN -11	8:13089
2425	NTIS MF A01- GPO $9.50	DE83005005	MN -11	8:13090
2526	NTIS (US Sales Only), PC A07/MF A01 - GPO $6.50	DE83004298	MN -78	8:12411

Report No.	Availability	Order No.	Distribution Category	Abstract No.
2558	NTIS, PC A10/MF A01 - GPO $7.50	DE83900721	MN -78	8:12412
2601-Vol.1	NTIS, PC A20/MF A01 - GPO $13.00	DE83004428	MN -78	8:12413
2650	NTIS, PC A03/MF A01	DE83003732	MN -41	8:13184
2701	NTIS, PC A04/MF A01 - GPO	DE83003925	MN -78	8:12414
2727-Vol.3	NTIS, PC A03/MF A01	DE83900850	MN -12	8:13175
2751-Vol.2	NTIS, PC A07/MF A01 - GPO	DE83002146	MN -78	8:12294
2797	NTIS, PC A04/MF A01 - GPO $5.00	DE83004300	MN -78	8:12295
2825	NTIS, PC A07/MF A01 - GPO	DE83003396	MN -78	8:12415
2832	NTIS, PC A04/MF A01 - GPO $4.75	DE83900893	MN -41	8:11928
2836-Vol.1-Pt.1	NTIS, PC A12/MF A01 - GPO $8.00	DE83901035	MN -80	8:12350
2836-Vol.1-Pt.2	NTIS, PC A07/MF A01 - GPO $6.00	DE83901036	MN -80	8:12296
2894	NTIS, PC A03/MF A01 - GPO $4.75	DE83004152	MN -70	8:11924
2899	NTIS, PC A02/MF A01 - GPO	DE83004010	MN -41	8:12416
2927	NTIS, PC A03/MF A01 - GPO	DE83003734	MN -80	8:12351
2966	NTIS, PC A05/MF A01 - GPO	DE83005348	MN -78	8:12352
2995	NTIS, PC A03/MF A01 - GPO $4.50	DE83900851	MN -11	8:13210
2997-Vol.1	NTIS, PC A04/MF A01 - GPO	DE83003701	MN -80	8:12353
3004	NTIS, PC A03/MF A01 - GPO $4.75	DE83004570	MN -41	8:13044
3006	NTIS, PC A12/MF A01 - GPO	DE83004284	MN -2	8:12854
3021	NTIS, PC A04/MF A01 - GPO $5.00	DE83900978	MN -11	8:13211
3040	NTIS, PC A06/MF A01 - GPO $6.00	DE83900031	MN -80	8:12417
3066	NTIS, PC A12/MF A01 - GPO $8.00	DE83900701	MN -70	8:11891
3102	NTIS, PC A07/MF A01 - GPO	DE83004210	MN -11	8:13212
NVO-				
214	NTIS, PC A10/MF A01	DE83004468	MN -41	8:13013
NYSERDA-				
82-9	Dept. of Communications, NYSERDA-Two Rockefeller Plaza, Albany, NY 12223		MN -90d	8:11679
82-12	New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY		MN -60	8:12264
82-18	New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, New York 12223		MN -95f	8:12623
82-19	New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, New York 12223		MN -95d	8:12478
OA-tr-				
2517	NTIS (US Sales Only), PC A03/MF A01	DE83900468	MN -13	8:12642
ONWI-				
2-Suppl.3	NTIS, PC A06/MF A01	DE82022248	MN -70	8:11892
9(81-4)	NTIS, PC A11/MF A01	DE83005479	MN -70	8:11893
9(82-1)	NTIS, PC A09/MF A01	DE83005478	MN -70	8:11894
251	NTIS, PC A16/MF A01	DE83004362	MN -70	8:11895
334-Vol.2-App.	NTIS, PC A11/MF A01	DE83005213	MN -70	8:11896
342	NTIS, PC A02/MF A01	DE83004364	MN -70	8:12740
348	NTIS, PC A04/MF A01	DE83005335	MN -70	8:11925
399	NTIS, PC A04/MF A01	DE83005249	MN -70	8:12825
400	NTIS, PC A10/MF A01	DE83004904	MN -70	8:11897
ORAU-				
206	NTIS, PC A03/MF A01	DE83004748	MN -13	8:12466
207	NTIS, PC A03/MF A01	DE83004749	MN -88	8:11738
ORNL-				
5695/ Pt.1	NTIS, PC A05/MF A01	DE83004174	MN -11	8:13197
5703	NTIS, PC A08/MF A01	DE83005178	MN -70	8:11898
5894	NTIS, PC A09/MF A01	DE83005180	MN -61a	8:12065
5897-Vol.1	NTIS, PC A10/MF A01	DE82018215	STD -34C	8:12342
5915	NTIS, PC A13/MF A01	DE83004690	STD -4	8:12759
5918	NTIS, PC A07/MF A01	DE83005156	STD -13	8:12508
5923	NTIS, PC A15/MF A01	DE83004692	STD -90d	8:11583
ORNL/CON-				
69	NTIS, PC A05/MF A01	DE83005168	MN -95d	8:12563
ORNL/CSD/TM-				
149	NTIS, PC A14/MF A01	DE83005179	MN -70	8:12855
191	NTIS, PC A02/MF A01	DE83005151	MN -32	8:12930
ORNL/EIS-				
194	*See* EPA-570/9-82-003	DE83005166	MN -11	8:13084
ORNL/NSIC-				
200-Vol.1-No.11	*See* NUREG/CR-2000-Vol.1-No.11	DE83004686	MN -80	8:12410
207	*See* NUREG/CR-2797	DE83004300	MN -78	8:12295
ORNL/SGMP-				
82/ 2	NTIS, PC A04/MF A01	DE83005167	MN -90c	8:11653
ORNL/Sub-				
79/ 33200/ 10	NTIS, PC A03/MF A01	DE83004198	MN -37	8:13489
ORNL/TM-				
7855	NTIS, PC A04/MF A01	DE83005173	STD -20g	8:13490
8104	NTIS MF A01	DE83004691	STD -70	8:11926
8106	NTIS, PC A03/MF A01	DE83005152	STD -20	8:13444
8107	NTIS, PC A04/MF A01	DE83005160	STD -20	8:13445
8120	NTIS, PC A04/MF A01	DE83005002	MN -61a	8:12066
8148	*See* NUREG/CR-2825	DE83003396	MN -78	8:12415
8369-Vol.1	*See* NUREG/CR-2751-Vol.2	DE83002146	MN -78	8:12294
8374	NTIS, PC A04/MF A01	DE83005157	MN -11	8:13062
8384	NTIS MF A01	DE83005155	STD -64	8:12132
8406	NTIS, PC A05/MF A01	DE83005175	MN -90d	8:11654
8438	NTIS, PC A08/MF A01	DE83005177	STD -90d	8:11655
8474	NTIS, PC A03/MF A01	DE83005153	STD -20b	8:13491
8479	NTIS, PC A03/MF A01	DE83005159	STD -41	8:13066

Report No.	Availability	Order No.	Distribution Category	Abstract No.
8483	NTIS, PC A02/MF A01	DE83005174	STD -86	8:11848
8494	NTIS, PC A07/MF A01	DE83004721	STD -66d	8:12241
8504	NTIS, PC A03/MF A01	DE83003349	STD -20d	8:13492
8515	NTIS, PC A03/MF A01	DE83004688	STD -20b	8:13493
8524	NTIS, PC A02/MF A01	DE83005172	MN -34	8:12648
8527-Vol.1	*See* NUREG/CR-2997-Vol.1	DE83003701	MN -80	8:12353
8533	NTIS, PC A02/MF A01	DE83005170	MN -48	8:13131
8589	NTIS, PC A04/MF A01	DE83005169	MN -37	8:13007
8593	NTIS, PC A03/MF A01	DE83005171	MN -34A	8:13494
ORNL-tr-				
4870	NTIS MF A01	DE82022182	MN -4	8:12773
4886	NTIS MF A01	DE82022501	MN -25	8:12702
4888	NTIS, PC A02/MF A01	DE83000250	MN -25	8:12703
4893	NTIS, PC A02/MF A01	DE83000075	MN -41	8:13095
4909	NTIS, PC A02/MF A01	DE83001764	MN -48	8:13173
4934	NTIS MF A01	DE83005027	MN -38	8:12875
ORO-				
2408-208	*See* DOE/ER/02408-208	DE83004558	MN -34C	8:13294
2408-209	*See* DOE/ER/02408-209	DE83004559	MN -34A	8:12915
2408-212	*See* DOE/ER/02408-212	DE83004561	MN -34C	8:13235
5197-15	NTIS, PC A03/MF A01	DE83005521	MN -91	8:11824
5262-5	NTIS, PC A14/MF A01	DE83006018	STD -95f	8:11808
5478-1	*See* DOE/CS/40095-T1	DE82021237	MN -95f	8:12619
P-				
700-81-011	California Energy Commission, 1111 Howe Ave., Sacramento, CA 95825		MN -98	8:12483
PATENTS-US-	(US: Commissioner of Patents, Washington, D.C. 20231, USA, $1.00 per copy. Government Patent Applications available from NTIS)			
A 6-182,367				8:12581
A 6-352,743		DE83002407		8:12861
A 6-352,744		DE83002408		8:12866
PB-				
82-252057	NTIS, PC A03/MF A01			8:11994
82-254863	NTIS, PC A10/MF A01			8:12164
82-256629	NTIS, PC A07/MF A01			8:12277
82-256835	NTIS, PC A04/MF A01			8:12624
82-257213	NTIS, PC A14/MF A01			8:12284
82-257494	NTIS, PC A08/MF A01			8:12549
82-257536	NTIS, PC A03/MF A01			8:12133
82-257676	NTIS, PC A08/MF A01			8:11993
82-258971	NTIS, PC A08/MF A01			8:12259
82-260100	NTIS, PC A08/MF A01			8:12165
83-100461	NTIS, PC A05/MF A01			8:12564
83-101782	NTIS, PC A04/MF A01			8:12278
83-102301	NTIS, PC A09/MF A01			8:12166
83-102319	NTIS, PC A06/MF A01			8:12167
83-102327	NTIS, PC A08/MF A01			8:12625
83-102335	NTIS, PC A07/MF A01			8:12523
83-102343	NTIS, PC A08/MF A01			8:12524
83-103994	NTIS, PC A05/MF A01			8:12279
83-107631	NTIS, PC A06/MF A01			8:12641
PFC/RR-				
82-30	*See* DOE/ET/51013-59	DE83005441	MN -20f	8:13423
82-34	*See* DOE/ET/51013-62	DE83005238	STD -20g	8:13474
PNL-				
3258	NTIS, PC A15/MF A01	DE83000096	MN -97a	8:13194
4109	*See* NUREG/CR-2423	DE83004572	MN -11	8:13089
4111	*See* NUREG/CR-2425	DE83005005	MN -11	8:13090
4164	*See* NUREG/CR-2526	DE83004298	MN -78	8:12411
4250-2	NTIS, PC A07/MF A01	DE83005125	MN -70	8:11899
4379	NTIS, PC A03/MF A01	DE83005126	MN -70	8:12687
4402	*See* NUREG/CR-2894	DE83004152	MN -70	8:11924
4406	NTIS, PC A06/MF A01	DE83004100	MN -11	8:13023
4458	*See* DOE/UMT-0212	DE83005253	MN -70A	8:11922
4490	NTIS, PC A09/MF A01	DE83005030	MN -70	8:11900
4509	*See* NUREG/CR-3004	DE83004570	MN -41	8:13044
4549	NTIS, PC A07/MF A01	DE83004993	MN -95d	8:12565
4551	NTIS, PC A05/MF A01	DE83004693	MN -95	8:12566
4552	NTIS, PC A04/MF A01	DE83004771	MN -95	8:12567
4580	NTIS, PC A03/MF A01	DE83005241	MN -32	8:13408
PNL-SA-				
7939-Rev.3	NTIS, PC A03/MF A01	DE83002736	MN -61a	8:12067
7982	NTIS, PC A02/MF A01	DE83002703	MN -94e	8:12450
8281	NTIS, PC A02/MF A01	DE83002737	MN -11	8:13030
8304	NTIS, PC A02/MF A01	DE83002704	MN -48	8:13392
8409	NTIS, PC A03/MF A01	DE83002755	MN -70	8:13558
9576	NTIS, PC A02/MF A01	DE83002741	MN -48	8:13156
9950	NTIS, PC A10/MF A01	DE83003653	MN -41	8:13393
9990	NTIS, PC A02/MF A01		MN -78	8:12418
10170	NTIS, PC A02/MF A01	DE83003646	MN -11	8:13045
10213	NTIS, PC A02/MF A01	DE83002713	MN -41	8:13046
10523	NTIS, PC A02/MF A01	DE83003476	MN -38	8:12881
10529	NTIS, PC A02/MF A01	DE83003456	MN -70B	8:11901
10534	NTIS, PC A02/MF A01	DE83005248	MN -70A	8:11902

Report No.	Availability	Order No.	Distribution Category	Abstract No.
10558	NTIS, PC A02/MF A01	DE83003461	MN -41	8:13031
10560	NTIS, PC A02/MF A01	DE83003658	MN -25	8:12760
10574	NTIS, PC A02/MF A01	DE83003657	MN -15	8:11941
10620	NTIS, PC A03/MF A01	DE83002754	MN -70A	8:11903
10646	NTIS, PC A99/MF A01	DE83002004	MN -61a	8:12068
10649	NTIS, PC A02/MF A01	DE83002738	MN -85	8:11904
10684	NTIS, PC A02/MF A01	DE83003462	MN -11	8:13047
10897	NTIS, PC A02/MF A01	DE83003596	MN -32	8:13559
10917	NTIS, PC A02/MF A01	DE83003597	MN -11	8:13024
PPPL-				
1951	NTIS, PC A03/MF A01	DE83005049	STD -20f	8:13446
1960	NTIS, PC A02/MF A01	DE83005050	STD -20d	8:13495
1961	NTIS, PC A03/MF A01	DE83005051	STD -20d	8:13447
1962	NTIS, PC A02/MF A01	DE83005052	STD -20d	8:13448
1964	NTIS, PC A03/MF A01	DE83004838	STD -20f	8:13449
1966	NTIS, PC A02/MF A01	DE83004886	STD -20d	8:13450
PUC-DEM-				
03/ 81	NTIS (US Sales Only), PC A03/MF A01	DE82703349	MN -78	8:12309
04/ 81	NTIS (US Sales Only), PC A06/MF A01	DE82703353	MN -79	8:12316
05/ 81	NTIS (US Sales Only), PC A03/MF A01	DE82703354	MN -79	8:12317
06/ 81	NTIS (US Sales Only), PC A03/MF A01	DE82703355	MN -79	8:12318
PUC-TN-				
03/ 81	NTIS (US Sales Only), PC A02/MF A01	DE82703371	MN -37	8:12761
RFP-Trans-				
339	NTIS, PC A03/MF A01	DE82021037	MN -25	8:12704
352	NTIS, PC A02/MF A01	DE83005021	MN -38	8:12717
RHO-BW-CR-				
129P	NTIS, PC A06/MF A01	DE83005495	MN -70	8:11905
RHO-BW-SA-				
198-P	NTIS, PC A03/MF A01	DE83004200	MN -11	8:13091
269-P	NTIS, PC A02/MF A01	DE83004676	MN -70	8:11906
RIFP-				
466	NTIS (US Sales Only), PC A02/MF A01	DE83900858	MN -34D	8:13279
RISLEY-Trans-				
4167	NTIS (US Sales Only), PC A02/MF A01	DE83900032	MN -41	8:12884
4174	NTIS (US Sales Only), PC A02/MF A01	DE83900466	MN -79g	8:12321
4186	NTIS (US Sales Only), PC A09/MF A01	DE83900452	MN -80	8:12447
RRC-				
49	NTIS (US Sales Only), PC A03/MF A01	DE83900584	MN -79	8:12319
SAI-				
78-856-LJ	*See* SAN-1492-1	DE83005522	STD -97d	8:12525
SAN-				
0499-46	*See* DOE/SF/10499-46	DE83001673	MN -62c	8:12120
0499-57-Vol.2	*See* CAPE-2770	DE83001837		8:12128
0499-57-Vol.3	*See* MDC-G-8544-Vol.3		MN -62c	8:12121
0499-81	*See* CAPE-2771	DE83001809		8:12127
1492-1	NTIS, PC A04/MF A01	DE83005522	STD -97d	8:12525
SAND-				
77-1332-Rev.	NTIS, PC A07/MF A01	DE83003822	MN -38	8:12870
80-1943	NTIS, PC A05/MF A01	DE83005199	STD -71	8:11852
80-2560	NTIS, PC A02/MF A01	DE83005244	MN -62a	8:12122
80-2712	*See* NUREG/CR-1935	DE83003698	MN -32	8:13557
81-0510	NTIS, PC A03/MF A01	DE83005364	MN -13	8:12871
81-1390	NTIS, PC A02/MF A01	DE82007100	MN -13	8:12872
81-1871	NTIS, PC A04/MF A01	DE83005362	MN -13	8:13014
81-2124	NTIS, PC A23/MF A01	DE83005378	STD -66c	8:12247
81-7080/ 4	NTIS, PC A05/MF A01	DE83005380	MN -63d	8:12112
81-7083/ 1	NTIS, PC A03/MF A01	DE83004763	MN -63c	8:12113
81-7085/ 14	NTIS, PC A03/MF A01	DE83005381	MN -63d	8:12114
81-7086/ 14	NTIS, PC A03/MF A01	DE83005377	MN -63d	8:12115
81-7087/ 3	NTIS, PC A03/MF A01	DE83005379	MN -63d	8:12116
81-7087/ 6	NTIS, PC A03/MF A01	DE83005489	MN -63d	8:12117
81-7188	NTIS, PC A09/MF A01	DE83005365	MN -63a	8:12118
82-0236	*See* NUREG/CR-2927	DE83003734	MN -80	8:12351
82-0435	NTIS, PC A04/MF A01	DE83005251	MN -13	8:12873
82-0460	NTIS, PC A10/MF A01	DE83004765	STD -70	8:11907
82-0664/ 1	NTIS PC E06/MF $8.20	DE83005119	STD -70	8:11908
82-0774	*See* NUREG/CR-2650	DE83003732	MN -41	8:13184
82-0930	NTIS, PC A03/MF A01	DE83004614	MN -32	8:13560
82-1222	NTIS, PC A12/MF A01	DE83004478	MN -41	8:12469
82-1279C	NTIS, PC A02/MF A01	DE83001364	MN -70	8:12688
82-1314	NTIS, PC A03/MF A01	DE83003769	MN -70	8:13219
82-1398-Vol.6-No.1	NTIS, PC A03/MF A01	DE83004127	MN -2	8:13500
82-1439C	NTIS MF A01	DE83005006	MN -70	8:11909
82-1483C	NTIS, PC A02/MF A01	DE83003008	MN -25	8:12715
82-1524	NTIS, PC A03/MF A01	DE83005383	MN -25	8:12689
82-1546	NTIS, PC A02/MF A01	DE83002193	MN -38	8:12882
82-1548C	NTIS, PC A03/MF A01	DE83004134	MN -38	8:12883
82-1550	NTIS, PC A07/MF A01	DE83004760	STD -23	8:13157
82-1600	NTIS, PC A03/MF A01	DE83005361	MN -62	8:12180
82-1711C	NTIS, PC A02/MF A01	DE83004012	MN -11	8:13213
82-1847C	NTIS, PC A02/MF A01	DE83003915	MN -34	8:12741
82-1870	*See* NUREG/CR-2899	DE83004010	MN -41	8:12416
82-1874C	NTIS, PC A02/MF A01	DE83003917	MN -34	8:12886
82-1885	NTIS, PC A03/MF A01	DE83005250	MN -23	8:12518

Report No.	Availability	Order No.	Distribution Category	Abstract No.
82-1903C	NTIS, PC A03/MF A01	DE83004013	MN -38	8:12725
82-2175	NTIS, PC A02/MF A01	DE83005360	MN -32	8:13561
82-2186C	NTIS, PC A02	DE83001268	ND -78	8:12419
82-2187C	NTIS, PC A02/MF A01	DE83005007	MN -91	8:13220
82-2250	NTIS, PC A02/MF A01	DE83004767	MN -32	8:13562
82-2259C	NTIS, PC A02/MF A01	DE83005008	MN -70	8:11910
82-2357	NTIS, PC A02/MF A01	DE83004764	MN -32	8:13563
82-2377	NTIS, PC A02/MF A01	DE83004761	STD -66	8:12248
82-2393	NTIS, PC A03/MF A01	DE83005363	MN -34D	8:12931
82-2529C	NTIS, PC A02/MF A01	DE83003916	MN -45	8:13011
82-2866C	NTIS, PC A02/MF A01	DE83004011	MN -70	8:11911
82-7037	NTIS, PC A09/MF A01	DE83005198	STD -66c	8:12249
82-7066	NTIS, PC A04	DE83004998	STD -71	8:11853
82-7092C	NTIS, PC A02/MF A01	DE83002513	MN -96	8:12651
82-7119	NTIS, PC A09/MF A01	DE83003835	MN -63c	8:12085
82-7128	NTIS, PC A11/MF A01	DE83004475	MN -63	8:12086
82-7134	NTIS, PC A06/MF A01	DE83004762	MN -63d	8:12087
82-8027	NTIS, PC A04/MF A01	DE83005035	MN -62d	8:12123
82-8657	NTIS, PC A03/MF A01	DE83004128	MN -90e	8:11771
82-8882	NTIS, PC A08/MF A01	DE83003149	MN -96	8:12832
SERI/CP-				
234-1590	NTIS, PC A15/MF A01	DE82022032	MN -61a	8:11983
SERI/PR-				
234-1850	NTIS, PC A03/MF A01	DE83005212	MN -61d	8:12092
8002-1-T3	NTIS, PC A03/MF A01	DE83005684	MN -63	8:12093
9318-2-T5	NTIS, PC A02/MF A01	DE83002804	MN -63c	8:12094
SERI/STR-				
231-1812	NTIS, PC A06/MF A01	DE83004755	MN -62	8:12181
231-1819	NTIS, PC A04/MF A01	DE83004697	MN -61a	8:12095
231-1820	NTIS, PC A03/MF A01	DE83004696	MN -61a	8:12096
SERI/TP-				
215-1758	NTIS, PC A02/MF A01	DE83003101	MN -63	8:12942
233-1697	NTIS, PC A03/MF A01	DE83005105	MN -61	8:12816
235-1814	NTIS, PC A02/MF A01	DE83005107	MN -61b	8:11956
SERI/TR-				
332-417	NTIS, PC A04/MF A01	DE83004725	MN -61	8:12097
635-1247	NTIS, PC A04/MF A01	DE83004410	MN -60	8:12260
9100-1-T4	NTIS, PC A09/MF A01	DE83003859	STD -63e	8:12098
SKBF-KBS-TR-				
81-13	NTIS (US Sales Only), PC A05/MF A01	DE82703377	MN -70	8:11912
SLAC-PUB-				
2963	NTIS, PC A03/MF A01	DE83004155	MN -34D	8:12932
2970	NTIS, PC A02/MF A01	DE83004391	MN -34D	8:13290
2972	NTIS, PC A02/MF A01	DE83004390	MN -32	8:13564
2976	NTIS, PC A02/MF A01	DE83004481	MN -34D	8:13280
2984	NTIS, PC A02/MF A01	DE83004416	MN -28	8:12992
2986	NTIS, PC A02/MF A01	DE83004417	MN -34D	8:12940
2987	NTIS, PC A02/MF A01	DE83004414	MN -28	8:12993
2992	NTIS, PC A02/MF A01	DE83004411	MN -34D	8:13266
2995	NTIS, PC A02/MF A01	DE83004154	MN -32	8:13565
2996	NTIS, PC A02/MF A01	DE83004419	MN -32	8:13566
SLAC-TN-				
82-3	NTIS, PC A02/MF A01	DE83004153	MN -28	8:12933
SLAC-Trans-				
0199	NTIS, PC A03/MF A01	DE83004170	MN -28	8:12941
SOLAR/0010-				
80/01	NTIS, PC A11/MF A01	DE83005516	STD -59	8:12013
SRD-R-				
203	United Kingdom Atomic Energy Authority, Culcheth Warrington WA3 4NE, England		ND -78	8:12354
SSS-R-				
81-4685-Vol.1	NTIS, PC A07/MF A01	DE83002682	MN -90c	8:11660
81-4942-Vol.2	NTIS, PC A04/MF A01	DE83002823	MN -90c	8:11661
TE-				
4258-442-82	NTIS, PC A03/MF A01	DE83004107	MN -93	8:12519
TENRAC/EDF-				
001	NTIS, PC A04/MF A01	DE83900789	MN -13	8:12511
002	NTIS, PC A04/MF A01	DE83900790	MN -13	8:12512
004	NTIS, PC A03/MF A01	DE83900791	MN -13	8:11998
005	NTIS, PC A05/MF A01	DE83900798	MN -98G	8:12467
006	NTIS, PC A10/MF A01		MN -58b	8:12017
009	NTIS, PC A08/MF A01	DE83900786	MN -13	8:12462
017	NTIS, PC A06/MF A01	DE83900801	MN -61a	8:12099
021	NTIS, PC A13/MF A01	DE83900830	MN -95	8:12463
026	NTIS, PC A04/MF A01	DE83900799	MN -59a	8:12168
027	NTIS, PC A05/MF A01	DE83900811	MN -95d	8:12568
028	NTIS, PC A03/MF A01	DE83900812	MN -95d	8:12569
029	NTIS, PC A03/MF A01	DE83900813	MN -95d	8:12570
038-Vol.1	NTIS, PC A10/MF A01	DE83900684	MN -95d	8:12571
039	NTIS, PC A18/MF A01	DE83900695	MN -90c	8:11662
041	NTIS, PC A04/MF A01	DE83900793	MN -94a	8:12572
042	NTIS, PC A04/MF A01	DE83900794	MN -90i	8:11687
045	NTIS, PC A12/MF A01	DE83900796	MN -66	8:12183
048	NTIS, PC A19/MF A01	DE83900877	MN -95	8:12550
051	NTIS, PC A13/MF A01	DE83900873	MN -95d	8:12573

Report No.	Availability	Order No.	Distribution Category	Abstract No.
052	NTIS, PC A07/MF A01	DE83900874	MN -61a	8:12100
053	NTIS, PC A04/MF A01	DE83900822	MN -61a	8:12101
054	NTIS, PC A04/MF A01	DE83900821	MN -62a	8:12124
055	NTIS, PC A04/MF A01	DE83900820	MN -95d	8:12574
056	NTIS, PC A05/MF A01	DE83900819	MN -59b	8:12169
057-Vol.1	NTIS, PC A05/MF A01	DE83900818	MN -11	8:13032
057-Vol.2	NTIS, PC A08/MF A01	DE83900817	MN -11	8:13033
059	NTIS, PC A03/MF A01	DE83900803	MN -95d	8:12575
062	NTIS, PC A03/MF A01	DE83900825	MN -60	8:12265
064	NTIS, PC A07/MF A01	DE83900823	MN -59	8:12170
065	NTIS, PC A08/MF A01	DE83900805	MN -95f	8:12102
066	NTIS, PC A08/MF A01	DE83900875	MN -61a	8:12103
067	NTIS, PC A04/MF A01	DE83900876	MN -94b	8:12576
070-Pt.1	NTIS, PC A05/MF A01	DE83900881	MN -96	8:12656
070-Pt.2	NTIS, PC A19/MF A01	DE83900880	MN -96	8:12657
071	NTIS, PC A03/MF A01	DE83900882	MN -60	8:12266
072	NTIS, PC A03/MF A01	DE83900816	MN -59b	8:12171
073	NTIS, PC A07/MF A01	DE83900815	MN -95d	8:12577
074	NTIS, PC A04/MF A01	DE83900814	MN -61a	8:12104
075	NTIS, PC A02/MF A01	DE83900870	MN -95d	8:12578
077	NTIS, PC A05/MF A01	DE83900872	MN -95	8:12579
078	NTIS, PC A03/MF A01		MN -95d	8:12580
079	NTIS, PC A07/MF A01	DE83900809	MN -90c	8:11785
080	NTIS, PC A02/MF A01	DE83900808	MN -59a	8:12172
082	NTIS MF A01	DE83900806	MN -59	8:12173
TR-				
5	*See* AD-A-118268/2			8:12023
81/ 031-001	*See* DOE/ET/10159-T18	DE83000831	MN -89	8:11600
82/ 031-005	*See* DOE/ET/10159-T25	DE83002171	MN -90	8:11579
TTC-				
0239	*See* SAND-80-1943	DE83005199	STD -71	8:11852
0316	*See* ORNL/CSD/TM-149	DE83005179	MN -70	8:12855
0325	*See* SAND-82-7066	DE83004998	STD -71	8:11853
0390	*See* SAND-82-1550	DE83004760	STD -23	8:13157
TVA/OACD-				
83/ 2	NTIS, PC A05/MF A01	DE83900363	MN -13	8:13139
TVA/PUB-				
83/ 12	NTIS, PC A03/MF A01	DE83900922	MN -13	8:12746
UAH-				
329	*See* DOE/CS/30013-U12	DE83005339	STD -98E	8:12014
UAH-RR-				
330	*See* DOE/CS/30013-U13	DE83005499	STD -98E	8:12635
331	*See* DOE/CS/30013-U14	DE83005498	STD -98E	8:11781
333	*See* DOE/CS/30013-U16	DE83005409	STD -90e	8:12636
UCID-				
19412-Vol.1	NTIS, PC A04/MF A01	DE83004372	MN -98E	8:12526
19412-Vol.2	NTIS, PC A03/MF A01	DE83004146	MN -98E	8:12527
19412-Vol.3	NTIS, PC A03/MF A01	DE83004294	MN -98E	8:12528
19412-Vol.4	NTIS, PC A03/MF A01	DE83004160	MN -98E	8:12529
19412-Vol.5	NTIS, PC A02/MF A01	DE83004299	MN -98E	8:12530
19604	NTIS, PC A02/MF A01	DE83004450	MN -34C	8:13378
19605	NTIS, PC A02/MF A01	DE83004219	MN -2	8:12690
19616	NTIS, PC A03/MF A01	DE83004681	MN -32	8:13379
19637	NTIS, PC A03/MF A01	DE83005032	MN -32	8:13567
19639	NTIS, PC A03/MF A01	DE83004449	MN -34D	8:12908
19640	NTIS, PC A02/MF A01	DE83005034	MN -25	8:13012
19643	NTIS, PC A02/MF A01	DE83005033	MN -32	8:13015
UCLA-				
12/ 1385	NTIS, PC A04/MF A01	DE83004454	STD -62	8:12125
12/ 1388	NTIS, PC A03/MF A01	DE83004451	STD -62	8:12126
UCRL-				
15367-Pt.3	NTIS, PC A03/MF A01	DE83004209	MN -21	8:13496
15495	*See* NUREG/CR-3102	DE83004210	MN -11	8:13212
15512	NTIS, PC A03/MF A01	DE83004218	MN -34A	8:12726
52000-82-11	NTIS, PC A03/MF A01	DE83003802	STD -2	8:11663
53043	*See* NUREG/CR-3006	DE83004284	MN -2	8:12854
53298	NTIS, PC A02/MF A01	DE83005029	STD -25	8:12727
53320	NTIS, PC A04/MF A01	DE83005028	STD -92b	8:11821
53338	NTIS, PC A03/MF A01	DE83005219	STD -70	8:11913
53345	NTIS, PC A02/MF A01	DE83002218	STD -11	8:13196
53364	NTIS, PC A09/MF A01	DE83004992	MN -4	8:13343
83045	NTIS, PC A02/MF A01	DE83005510	MN -78	8:12420
83592	NTIS, PC A03/MF A01	DE83005508	MN -38	8:12793
86222	NTIS, PC A02/MF A01	DE83004307	MN -37	8:12994
87122	NTIS, PC A02/MF A01	DE83004305	MN -21	8:13497
87217	NTIS, PC A02/MF A01	DE83003879	MN -11	8:13221
87250	NTIS, PC A02/MF A01	DE83004247	MN -15	8:11942
87491	NTIS, PC A03/MF A01	DE83005390	MN -34A	8:13452
87546-Rev.1	NTIS, PC A02/MF A01	DE83004287	MN -4	8:12728
87727	NTIS, PC A02/MF A01	DE83004207	MN -38	8:12448
87728	NTIS, PC A02/MF A01	DE83004208	MN -38	8:13008
87735-Rev.1	NTIS, PC A02/MF A01	DE83004285	MN -20	8:13498
87760	NTIS, PC A02/MF A01	DE83004310	MN -34B	8:12909
87768	NTIS, PC A02/MF A01	DE83004301	MN -34D	8:12934
87802-Rev.1	NTIS, PC A02/MF A01	DE83003018	MN -66b	8:12202

Report No.	Availability	Order No.	Distribution Category	Abstract No.
88181	NTIS, PC A02/MF A01	DE83003876	MN -4	8:12716
88233	NTIS, PC A02/MF A01	DE83004306	MN -96	8:12647
88233-Rev.1	NTIS, PC A02/MF A01	DE83003878	MN -96	8:12643
88254	NTIS, PC A02/MF A01	DE83004217	MN -85	8:11854
88314	NTIS, PC A02/MF A01	DE83004220	MN -34	8:12887
88315	NTIS, PC A02/MF A01	DE83004302	MN -34A	8:13409
88334	NTIS, PC A02/MF A01	DE83004318	MN -25	8:12742
88359	NTIS, PC A02/MF A01	DE83004141	MN -32	8:13568
88400	NTIS, PC A02/MF A01	DE83003884	MN -25	8:12691
88425	NTIS, PC A02/MF A01	DE83003880	MN -41	8:13092
88465	NTIS, PC A03/MF A01	DE83004143	MN -32	8:13536
88474	NTIS, PC A02/MF A01	DE83004288	MN -25	8:13016
88475	NTIS, PC A02/MF A01	DE83004805	MN -34B	8:13569
88481	NTIS, PC A02/MF A01	DE83004304	MN -13	8:13099
UFF-IF-				
03/ 81	NTIS (US Sales Only), PC A02/MF A01	DE82703335	MN -80	8:12361
UFRJ-COPPE-PEN-				
102	NTIS (US Sales Only), PC A02/MF A01	DE82703336	MN -80	8:12343
107	NTIS (US Sales Only), PC A02/MF A01	DE82703340	MN -80	8:12355
USAE-WES-C-				
78-1	*See* ONWI-342	DE83004364	MN -70	8:12740
USGS-OFR-				
82-478	NTIS, PC A03/MF A01	DE83005619	STD -70	8:13214
USGS-PP-				
1141	GPO		MN -66	8:12187
UT/CES-PS-				
20	NTIS, PC A03/MF A01	DE83900700	MN -98C	8:11819
UTRC-R-				
82-955621	*See* PB-82-254863			8:12164
UTSI-				
82-21	*See* DOE/ET/10815-75	DE83004815	STD -90g	8:12513
82/ 22	*See* DOE/ET/10815-77	DE83004816	STD -90g	8:12514
Y-				
2277	NTIS, PC A03/MF A01	DE83005176	STD -38	8:12856
Y/DV-				
252	NTIS, PC A02/MF A01	DE83004839	MN -25	8:12692
Y/DX-				
103	NTIS, PC A02/MF A01	DE83005509	MN -38	8:13499
111	NTIS, PC A02/MF A01	DE83005511	MN -38	8:12857
Y/IA-				
156	NTIS, PC A02/MF A01	DE83004061	MN -37	8:12888
Y/Sub-				
80-7733/ 1-01	NTIS, PC A05/MF A01	DE83005073	MN -38	8:12720
ZfI-Mitt-				
43a	NTIS (US Sales Only), PC A12/MF A01	DE83780129	MN -34A	8:13242
43b	NTIS (US Sales Only), PC A12/MF A01	DE83780130	MN -34A	8:12743
ZfK-				
463	NTIS (US Sales Only), PC A06/MF A01	DE82703065	MN -2	8:12472

ORDER NUMBER CORRELATION

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Order No.	*Report No.*
DE81031968	BNL—30030
DE82006211	DOE/ET/15614—2
DE82007100	SAND—81-1390
DE82007138	GJBX—21-82
DE82007139	GJBX—24-82
DE82010053	GJBX—25-82
DE82012152	LA-UR—82-870
DE82015865	DOE/EP/12040—T1
DE82015926	GFETC/IC—82/1
DE82017546	CONF-820112—11
DE82018215	ORNL—5897-Vol.1
DE82018727	DOE/AF/92017—T2
DE82019281	DOE/CS/40310—T1
DE82019415	DOE/MC/16229—T5
DE82020324	KMSF-U—1266
DE82021026	NBSIR—82-2552
DE82021037	RFP-Trans—339
DE82021084	DOE/ET/12103—T4
DE82021147	ANL—81-79
DE82021175	DOE/CS/50045—T1
DE82021237	DOE/CS/40095—T1
DE82021625	DOE/EV/03522—25
DE82021797	DOE/FE/14185—T4
DE82021934	DOE/NBM—2021934
DE82022032	SERI/CP—234-1590
DE82022182	ORNL-tr—4870
DE82022190	CONF-7807110—
DE82022248	ONWI—2-Suppl.3
DE82022501	ORNL-tr—4886
DE82703058	CEA-CONF—6259
DE82703059	AERE-R—10516
DE82703060	CEA-CONF—6241
DE82703061	IAEA-NDS—22
DE82703062	IAEA-NDS—7(Rev.1)
DE82703063	CEA-N—2275
DE82703064	ECN—117
DE82703065	ZfK—463
DE82703315	CERN—82-05
DE82703316	ITEF—102(1981)
DE82703317	ITEF—107(1981)
DE82703318	JINR—9-81-682
DE82703319	JINR-R—11-81-813
DE82703320	JINR-R—9-81-639
DE82703321	JINR-R—9-81-664
DE82703322	JINR-R—9-81-685
DE82703323	JINR-R—9-81-712
DE82703324	JINR-R—9-81-734
DE82703325	JINR-R—9-81-809
DE82703326	LYCEN—8134
DE82703327	NIIEFA-P-FD—0531
DE82703328	EUR—7443
DE82703329	AAEC/E—539
DE82703332	BARC—1129
DE82703333	IAE—3376/5
DE82703334	ITEF—106(1981)
DE82703335	UFF-IF—03/81
DE82703336	UFRJ-COPPE-PEN—102
DE82703337	CEA-CONF—6157
DE82703338	EUR—7424
DE82703339	LCC—017/81
DE82703340	UFRJ-COPPE-PEN—107
DE82703341	IPEN-Inf—08
DE82703342	IPEN-Inf—09
DE82703343	NUCLEBRAS-CDTN—434/81
DE82703344	INFO—0056
DE82703345	EUR—7575
DE82703346	BLG—552
DE82703347	CEA-N—2259
DE82703348	ELETROBRAS-CDTN—01/81
DE82703349	PUC-DEM—03/81
DE82703351	CTA-EAV-NT—003/81
DE82703352	CTA-EAV-NT—004/81
DE82703353	PUC-DEM—04/81
DE82703354	PUC-DEM—05/81
DE82703355	PUC-DEM—06/81
DE82703357	CBPF-NF—035/81
DE82703359	CERN—82-06
DE82703360	IPEN-Pub—31
DE82703361	IPEN-Pub—32
DE82703363	IPNO—81-04
DE82703364	IPNO-RC—81-08
DE82703365	JINR—13-81-727
DE82703366	JINR—13-81-782
DE82703367	KFTI—81-40
DE82703368	LAPP—81-04
DE82703369	LYCEN—8149
DE82703370	NRPB-IE—21
DE82703371	PUC-TN—03/81
DE82703372	AERE-R—10409
DE82703374	BARC—1133
DE82703375	CEA-N—2254
DE82703376	CERN—82-07
DE82703377	SKBF-KBS-TR—81-13
DE82703378	IFUSP-P—266
DE82703379	IFUSP-P—296
DE82703380	CNEN-DR—87/80
DE82703381	CNEN-DR—89/80
DE82703382	INFO—0051
DE82703383	INFO—0052
DE82703384	INFO—0054
DE82703385	INFO—0055
DE82703386	INFO—0059
DE82703387	EUR—7580
DE82703389	CEA-N—2262
DE82703390	LCC—010/81
DE82703391	CEA-N—2268
DE82703392	CNEN-DR—102/81
DE82703393	EUR—7427(pt.1)
DE82703394	FEI—1241
DE82703395	IFVE-OEA—81-170
DE82703396	IFVE-OMVT/OUNK—81-121
DE82750918	BMFT-FB-T—094
DE82750920	KFK—3287
DE82750921	ASA-I—38/79
DE82750922	Juel—1737
DE82750923	KFK—3332
DE82750924	DESY—82-025
DE82750925	DESY—82-024
DE82750926	DESY—82-023
DE82750927	DESY—82-022
DE82750928	KFK—3074
DE82750929	KFK—3301
DE82750930	KFK—3327
DE82750931	KFK—3227B
DE82750932	KFK—3209
DE82750933	GKSS—82/E/4
DE82750935	KFK—3318
DE82750936	KFK—3240
DE82750937	IPP—4/205
DE82750938	DESY-SR—82-02
DE82750939	DESY-SR—82-04
DE82750941	KFK—3309
DE82750942	KFK—3291
DE82750943	KFK—3292
DE82750944	ATS-TUH—1081
DE82780782	INIS-mf—7038
DE82903130	CNEN-RT/PROT—(81)5
DE82904405	BMFT-FB-RS—179-Pt.2
DE82905463	CONF-8108141—
DE82905800	Juel-Conf—42-Vol.2
DE82905921	NUREG/BR—0051-Vol.4-No.4
DE83000075	ORNL-tr—4893
DE83000096	PNL—3258
DE83000160	DOE/ET/53042—13
DE83000250	ORNL-tr—4888
DE83000436	DOE/MC/16140—T2
DE83000772	DOE/ID/12274—T1-Vol.6
DE83000831	DOE/ET/10159—T18
DE83000948	DOE/ET/21106—T1
DE83001147	DOE/CH/10122—7
DE83001186	DOE/RA/50338—1-Attach.B-Vol.3
DE83001199	DOE/RA/50338—1-Vol.1
DE83001241	LA-tr—82-28
DE83001268	SAND—82-2186C
DE83001278	DOE/CS/14287—T2
DE83001364	SAND—82-1279C
DE83001390	DOE/ET/10069—T21
DE83001643	DOE/ET/14801—30
DE83001673	DOE/SF/10499—46
DE83001764	ORNL-tr—4909
DE83001809	CAPE—2771
DE83001837	CAPE—2770
DE83001864	DOE/FC/10297—T4
DE83001913	DOE/RG/10076—T1
DE83002004	PNL-SA—10646
DE83002034	CAPE—2772
DE83002100	FERMILAB-Conf—82/69-EXP
DE83002110	NUREG/CR—2317-Vol.2-No.1
DE83002146	NUREG/CR—2751-Vol.2
DE83002162	DOE/CS/21348—T1
DE83002171	DOE/ET/10159—T25
DE83002195	SAND—82-1546
DE83002204	DOE/RA/50298—T1-Vol.2
DE83002205	DOE/ER/10343—04
DE83002218	UCRL—53345
DE83002234	DOE/PC/42295—T5
DE83002247	BNL—51432-Rev.A
DE83002471	DOE/PC/40796—4
DE83002492	DOE/RA/50292—T1
DE83002513	SAND—82-7092C
DE83002537	DOE/SF/11525—T2
DE83002558	CONF-821124—14
DE83002682	SSS-R—81-4685-Vol.1
DE83002685	DOE/PC/40783—T8
DE83002686	DOE/GET—83/1
DE83002687	DP-MS—82-42
DE83002700	GJBX—196-82-Vol.2A

Order No.	Report No.
DE83002701	GJBX—196-82-Vol.2B
DE83002703	PNL-SA—7982
DE83002704	PNL-SA—8304
DE83002713	PNL-SA—10213
DE83002715	ANL/LRP-TM—22
DE83002724	GJBX—196-82-Vol.2D
DE83002726	GJBX—196-82-Vol.2C
DE83002733	GEND—012
DE83002735	DOE/ER/12028—1
DE83002736	PNL-SA—7939-Rev.3
DE83002737	PNL-SA—8281
DE83002738	PNL-SA—10649
DE83002741	PNL-SA—9576
DE83002753	MIT/EL—81-031
DE83002754	PNL-SA—10620
DE83002755	PNL-SA—8409
DE83002773	DOE/ET/12231—T1
DE83002778	GTFR—36
DE83002804	SERI/PR—9318-2-T5
DE83002808	DOE/PC/41760—T2
DE83002818	BNL—32086
DE83002823	SSS-R—81-4942-Vol.2
DE83002827	BNL—32143
DE83002840	BNL—32087
DE83002858	DOE/ER/10697—T1
DE83003007	CONF-821011—41
DE83003008	SAND—82-1483C
DE83003018	UCRL—87802-Rev.1
DE83003020	DOE/FE/15066—1199
DE83003029	DOE/EV/10019—6
DE83003045	DOE/PC/53030—T1
DE83003048	DOE/ER/10624—3
DE83003064	DOE/FE/05147—T11
DE83003087	DOE/MC/14101—1126
DE83003089	DOE/ER/03443—T1
DE83003101	SERI/TP—215-1758
DE83003129	EGG-PHYS—6003
DE83003135	DOE/R5/10314—2
DE83003145	DOE/LLW—6T
DE83003149	SAND—82-8882
DE83003159	DOE/ET/13046—T82
DE83003213	GA-A—16784
DE83003217	BNL—30628
DE83003218	GA-A—16748
DE83003220	DOE/ET/27204—T1-Vol.2-App.Sect.1
DE83003224	MLM—3029
DE83003225	EGG-M—20482
DE83003227	DOE/PC/30205—4
DE83003241	EGG-M—18582
DE83003243	EGG-M—15682
DE83003244	EGG-M—15782
DE83003246	EGG-M—24282
DE83003252	EGG-M—22482
DE83003272	DOE/ET/37240—98TR-Pt.1
DE83003273	DOE/ET/37240—98TR-Pt.2
DE83003283	DOE/CS/54209—10
DE83003302	DOE/ET/15397—T5
DE83003314	DOE/LLW—12T
DE83003338	DP—1640
DE83003349	ORNL/TM—8504
DE83003361	DOE/ET/11430—T1
DE83003393	DOE/ET/34030—4
DE83003396	NUREG/CR—2825
DE83003397	CONF-821128—2
DE83003400	DOE/EV/04024—T1
DE83003409	GJBX—196-82-Vol.1
DE83003411	CONF-811108—21-Draft
DE83003419	CONF-821107—33
DE83003426	GEPP-TIS—696
DE83003436	CONF-8111132—1
DE83003448	DOE/ID/12065—T1
DE83003453	CONF-821107—30
DE83003454	CONF-821103—49
DE83003456	PNL-SA—10529
DE83003461	PNL-SA—10558
DE83003462	PNL-SA—10684
DE83003476	PNL-SA—10523
DE83003480	CONF-821101—16
DE83003482	CONF-8210105—1
DE83003504	CONF-811150—10-Draft
DE83003513	GJBX—169-82
DE83003533	LA-UR—82-3380
DE83003534	LA-UR—82-3334
DE83003535	LA-UR—82-3330
DE83003536	LA-UR—82-3328
DE83003537	LA-UR—82-3324
DE83003539	LA-UR—82-3322
DE83003540	LA-UR—82-3323
DE83003542	LA-UR—82-3279
DE83003560	LA-UR—82-3398
DE83003565	LA-UR—82-3267
DE83003568	LA-UR—82-3289
DE83003569	LA-UR—82-3290
DE83003575	LA-UR—82-3317
DE83003584	DOE/ET/25207—1
DE83003586	DOE/ER/12044—1
DE83003594	DOE/CS/40327—T4
DE83003596	PNL-SA—10897
DE83003597	PNL-SA—10917
DE83003611	DOE/CS/83001—T1
DE83003617	DOE/BC/10102—1
DE83003625	DOE/PC/41030—T1
DE83003631	ANL/CNSV-TM—103
DE83003637	DOE/ET/14880—T2
DE83003638	LA-UR—82-3338
DE83003646	PNL-SA—10170
DE83003653	PNL-SA—9950
DE83003657	PNL-SA—10574
DE83003658	PNL-SA—10560
DE83003670	DOE/NASA/10769—28
DE83003698	NUREG/CR—1935
DE83003701	NUREG/CR—2997-Vol.1
DE83003707	DOE/ER/40039—6
DE83003721	EGG-PHYS—5890
DE83003722	EGG-FM—6046
DE83003725	DOE/CS/40327—T3
DE83003732	NUREG/CR—2650
DE83003734	NUREG/CR—2927
DE83003737	DOE/RA/50353—T1-Vol.2
DE83003755	DOE/PC/30076—T4
DE83003759	LBL—15089
DE83003764	DOE/ER/10361—3-3A
DE83003769	SAND—82-1314
DE83003787	DOE/PC/30300—T7
DE83003790	IS-M—390
DE83003791	IS-M—384
DE83003792	IS-M—389
DE83003793	IS-M—388
DE83003798	DOE/EIA/10683—T1
DE83003800	DOE/EIA/10683—T2
DE83003802	UCRL—52000-82-11
DE83003803	MLM—3028
DE83003815	IS-RIC-PR—3
DE83003822	SAND—77-1332-Rev.
DE83003835	SAND—82-7119
DE83003838	DOE/AL/10563—T16
DE83003840	DOE/CS/24317—2
DE83003847	DOE/EIS—0083-F
DE83003858	DOE/AL/10563—T15
DE83003859	SERI/TR—9100-1-T4
DE83003860	DOE/PC/40807—T5
DE83003869	DOE/ET/47916—1-Vol.4
DE83003872	DOE/EV/10306—T3
DE83003876	UCRL—88181
DE83003878	UCRL—88233-Rev.1
DE83003879	UCRL—87217
DE83003880	UCRL—88425
DE83003884	UCRL—88400
DE83003890	LA—9539-MS
DE83003891	LA—9329-MS
DE83003896	LA—9559-MS
DE83003906	EGG-WM—5792-Rev.1
DE83003909	DOE/ER/10881—T1
DE83003915	SAND—82-1847C
DE83003916	SAND—82-2529C
DE83003917	SAND—82-1874C
DE83003921	DOE/CS/24448—T1
DE83003923	DOE/PC/40801—T5
DE83003925	NUREG/CR—2701
DE83003929	BNL—32210
DE83003938	BNL—32212
DE83003939	BNL—32264
DE83003945	BNL—32263
DE83003950	BNL—32147
DE83003955	BNL—32230
DE83003956	BNL—32169
DE83003957	BNL—32168
DE83003958	BNL—32178
DE83003959	BNL—32190
DE83003960	BNL—32172
DE83003961	BNL—32167
DE83003965	BNL—32132
DE83003975	GEAP—22211
DE83003978	LBL—12811
DE83003984	LBL—14471
DE83003986	LBL—14234
DE83003996	LA—9466-MS
DE83003997	LA—9570-MS
DE83003999	LA—9544-M
DE83004003	EPRI-EM—2351-Vol.4
DE83004010	NUREG/CR—2899
DE83004011	SAND—82-2866C
DE83004012	SAND—82-1711C
DE83004013	SAND—82-1903C
DE83004017	DOE/PC/40809—T4
DE83004023	DOE/RL—82-11
DE83004024	DOE/RL—82-10
DE83004025	DOE/RL—82-9
DE83004026	DOE/RL—82-8
DE83004027	DOE/RL—82-7
DE83004028	DOE/RL—82-6
DE83004030	DOE/RL—82-4
DE83004031	DOE/MC/16022—1307
DE83004059	LBL—13840
DE83004061	Y/IA—156
DE83004062	DOE/RL—82-13
DE83004063	DOE/RL—82-12
DE83004065	FERMILAB-CONF—82/67-THY
DE83004068	HEDL-SA—2765-FP
DE83004071	HEDL-SA—2692-FP
DE83004072	HEDL-SA—2719
DE83004073	HEDL-SA—2790
DE83004074	DOE/RL—82-14
DE83004079	DOE/ER/10985—1
DE83004083	DOE/ER/10556—92
DE83004091	DOE/PC/40077—4
DE83004092	DOE/PC/40077—5
DE83004098	BDX—613-2854
DE83004100	PNL—4406
DE83004105	DOE/ER/53091—T5
DE83004106	DOE/ER/40048—27-L2
DE83004107	TE—4258-442-82
DE83004108	DOE/CS/30386—T1
DE83004116	LBL—15071
DE83004117	LBL—14464
DE83004126	BDX—613-2876
DE83004127	SAND—82-1398-Vol.6-No.1
DE83004128	SAND—82-8657
DE83004130	DOE/NE—0048
DE83004133	DOE/NV/10249—3
DE83004134	SAND—82-1548C
DE83004135	DOE/PC/40789—T4
DE83004137	DOE/RG/10268—T2
DE83004141	UCRL—88359
DE83004143	UCRL—88465
DE83004146	UCID—19412-Vol.2
DE83004152	NUREG/CR—2894
DE83004153	SLAC-TN—82-3
DE83004154	SLAC-PUB—2995
DE83004155	SLAC-PUB—2963
DE83004158	LBL—14766
DE83004160	UCID—19412-Vol.4
DE83004170	SLAC-Trans—0199
DE83004174	ORNL—5695/Pt.1
DE83004181	LBL—14916
DE83004182	LBL—15220
DE83004183	DOE/PC/30298—T9
DE83004189	LBL—7520-Rev.
DE83004190	LBL—14980
DE83004191	LBL—14623
DE83004192	LBL—14624
DE83004193	LBL—14456
DE83004194	DOE/ET/23197—T9
DE83004198	ORNL/Sub—79/33200/10
DE83004199	K/TD—409
DE83004200	RHO-BW-SA—198-P
DE83004207	UCRL—87727
DE83004208	UCRL—87728
DE83004209	UCRL—15367-Pt.3
DE83004210	NUREG/CR—3102
DE83004216	DOE/ER/54008—T1
DE83004217	UCRL—88254
DE83004218	UCRL—15512

Order No.	Report No.
DE83004219	UCID—19605
DE83004220	UCRL—88314
DE83004241	LBL—15244
DE83004247	UCRL—87250
DE83004262	DOE/PC/50254—T1
DE83004270	LBL—15225
DE83004278	DOE/ET/34013—5
DE83004281	DOE/IR/11160—T1
DE83004282	DOE/PC/30223—6
DE83004284	NUREG/CR—3006
DE83004285	UCRL—87735-Rev.1
DE83004287	UCRL—87546-Rev.1
DE83004288	UCRL—88474
DE83004294	UCID—19412-Vol.3
DE83004295	LBL—15156
DE83004298	NUREG/CR—2526
DE83004299	UCID—19412-Vol.5
DE83004300	NUREG/CR—2797
DE83004301	UCRL—87768
DE83004302	UCRL—88315
DE83004304	UCRL—88481
DE83004305	UCRL—87122
DE83004306	UCRL—88233
DE83004307	UCRL—86222
DE83004310	UCRL—87760
DE83004312	DOE/ID/12044—T2
DE83004313	DOE/PC/40812—T5
DE83004315	DOE/PC/40793—T5
DE83004318	UCRL—88334
DE83004319	LALP—82-34
DE83004333	DOE/ER/10587—2
DE83004340	DOE/FC—1009
DE83004342	DOE/ER/01545—325
DE83004347	DOE/ET/14809—12
DE83004362	ONWI—251
DE83004364	ONWI—342
DE83004372	UCID—19412-Vol.1
DE83004379	DOE/ER/10946—3
DE83004386	DOE/ER/03077—176
DE83004387	DOE/R5/10247—1
DE83004388	DOE/ET/15420—T1
DE83004389	DOE/ER/10878—T1
DE83004390	SLAC-PUB—2972
DE83004391	SLAC-PUB—2970
DE83004392	FERMILAB-Conf—82/97-EXP
DE83004394	DOE/RA/50328—T1
DE83004396	DOE/MA—0090
DE83004400	ANL—82-73
DE83004402	DOE/ER/71294—T2
DE83004410	SERI/TR—635-1247
DE83004411	SLAC-PUB—2992
DE83004414	SLAC-PUB—2987
DE83004416	SLAC-PUB—2984
DE83004417	SLAC-PUB—2986
DE83004419	SLAC-PUB—2996
DE83004424	DOE/ER/10841—5
DE83004426	DOE/ER/04900—3
DE83004428	NUREG/CR—2601-Vol.1
DE83004431	KAPL—4135
DE83004435	ANL/NDM—73
DE83004436	ANL/NDM—68
DE83004437	ANL/NDM—64
DE83004442	DOE/ER—0155
DE83004443	DOE/RG/10295—1
DE83004445	DOE/RG/10572—1
DE83004447	DOE/ID/12044—T1
DE83004449	UCID—19639
DE83004450	UCID—19604
DE83004451	UCLA—12/1388
DE83004452	MTR—80W215-03
DE83004454	UCLA—12/1385
DE83004455	GEAP—22077
DE83004456	GEAP—24381
DE83004459	CONF-8203103—
DE83004460	DOE/ET/14803—T7
DE83004462	CONF-821217—1
DE83004463	CONF-821217—2
DE83004464	FERMILAB-CONF—82/87
DE83004465	LBL—15252
DE83004466	LBL—15251
DE83004467	LBL—15073
DE83004468	NVO—214
DE83004475	SAND—82-7128
DE83004478	SAND—82-1222
DE83004481	SLAC-PUB—2976
DE83004482	GJBX—172-82
DE83004484	GJBX—167-82
DE83004486	GJBX—166-82
DE83004487	GJBX—165-82
DE83004495	DOE/ER/02172—39
DE83004505	HEDL-SA—2747
DE83004506	HEDL-SA—2729S
DE83004507	CONF-821216—8
DE83004508	CONF-821216—9
DE83004509	FERMILAB-Conf—82/86
DE83004510	CONF-821216—3
DE83004512	DOE/CS/30339—T1
DE83004519	DOE/MC/16024—T4
DE83004522	DOE/ER/02184—T1
DE83004523	DOE/ER/12064—1
DE83004526	DOE/PC/40009—T3
DE83004528	BROWN/HET—480
DE83004529	GJBX—173-82
DE83004554	GJBX—170-82
DE83004555	FERMILAB/TM—1148
DE83004557	DOE/EV/05888—05
DE83004558	DOE/ER/02408—208
DE83004559	DOE/ER/02408—209
DE83004561	DOE/ER/02408—212
DE83004562	DOE/ER/02408—213
DE83004563	DOE/ER/10638—3
DE83004564	GJBX—177-82
DE83004566	DOE/PC/40799—T5
DE83004568	CONF-820419—Suppl.
DE83004569	DOE/ER/10714—2
DE83004570	NUREG/CR—3004
DE83004572	NUREG/CR—2423
DE83004574	DOE/ER/04447—152
DE83004577	DOE/PC/40799—T4
DE83004578	DOE/EV/04267—06
DE83004579	DOE/R5/10316—T1
DE83004580	DOE/OR/00033—T12
DE83004581	CONF-8103153—1
DE83004582	BNL—32297
DE83004588	DOE/ER/10604—3
DE83004590	BNL—32237
DE83004591	BNL—32275
DE83004594	BNL—32247
DE83004595	DOE/PC/40009—T1
DE83004596	DOE/PC/40009—T2
DE83004597	DOE/ET/10587—T1-Pt.3
DE83004599	BNL—32304
DE83004601	BNL—32239
DE83004602	BNL—32211
DE83004603	BNL—32208
DE83004604	BNL—32255
DE83004607	CONF-821216—1
DE83004608	CONF-821216—6
DE83004609	CONF-821216—4
DE83004614	SAND—82-0930
DE83004616	CONF-821213—3
DE83004618	DOE/PC/50816—1
DE83004624	DPST—82-128-2
DE83004630	BNL—32174
DE83004631	BNL—32175
DE83004634	BNL—32173
DE83004635	DOE/DP/40030—4
DE83004641	DOE/ID/12030—T3
DE83004642	DOE/EV/03380—38
DE83004643	DOE/ER/53136—2
DE83004644	CONF-821213—2
DE83004645	CONF-821152—1
DE83004646	CONF-821136—6
DE83004650	CONF-821220—1
DE83004651	CONF-821218—1
DE83004652	CONF-821216—2
DE83004676	RHO-BW-SA—269-P
DE83004678	CONF-821107—41
DE83004679	GA-A—16885
DE83004681	UCID—19616
DE83004682	DOE/ER/10428—4
DE83004683	DOE/ER/03227—76
DE83004684	DOE/ET/25402—T1
DE83004685	DOE/PC/30300—T6
DE83004686	NUREG/CR—2000-Vol.1-No.11
DE83004687	DOE/AD/11257—T1
DE83004688	ORNL/TM—8515
DE83004690	ORNL—5915
DE83004691	ORNL/TM—8104
DE83004692	ORNL—5923
DE83004693	PNL—4551
DE83004694	DOE/RG/10572—3-Vol.1
DE83004695	DOE/ET/20279—222
DE83004696	SERI/STR—231-1820
DE83004697	SERI/STR—231-1819
DE83004705	DOE/ER/03956—T1
DE83004706	DOE/FE/00103—T1
DE83004712	DOE/PC/50798—1
DE83004713	DOE/RA/50317—T1
DE83004714	DOE/RA/50320—T1
DE83004721	ORNL/TM—8494
DE83004723	DOE/EV/10019—16-Vol.2
DE83004725	SERI/TR—332-417
DE83004727	LA-UR—82-3483
DE83004728	LA-UR—82-3488
DE83004729	LA-UR—82-3489
DE83004730	LA-UR—82-3500
DE83004731	LA-UR—82-3525
DE83004732	LA-UR—82-3550
DE83004733	LA-UR—82-3557
DE83004734	LA-UR—82-3563
DE83004735	LA-UR—82-3566
DE83004737	LA-UR—82-3578
DE83004740	LA-UR—82-3621
DE83004741	LA-UR—82-3634
DE83004742	LA-UR—82-3641
DE83004743	LA-UR—82-3657
DE83004744	LA-UR—82-3658
DE83004746	LA-UR—82-3681
DE83004747	DP—1645
DE83004748	ORAU—206
DE83004749	ORAU—207
DE83004750	DOE/CS/24311—1
DE83004751	DOE/CS/20234—2
DE83004753	DOE/RA/23211—4
DE83004754	DOE/NV/10250—4
DE83004755	SERI/STR—231-1812
DE83004759	DOE/EIA—0131-81
DE83004760	SAND—82-1550
DE83004761	SAND—82-2377
DE83004762	SAND—82-7134
DE83004763	SAND—81-7083/1
DE83004764	SAND—82-2357
DE83004765	SAND—82-0460
DE83004767	SAND—82-2250
DE83004768	DOE/CS/30149—5
DE83004770	DOE/NV/10250—5
DE83004771	PNL—4552
DE83004772	DOE/RA/50298—T1-Vol.3
DE83004773	DOE/RA/50298—T1-Vol.4
DE83004775	DOE/SF/11429—1
DE83004776	DOE/NV/10194—2
DE83004777	DOE/NV/10194—1
DE83004778	DOE/EV/03221—74
DE83004779	DOE/EV/03221—73
DE83004780	DOE/RA/50298—T1-Vol.1-App.
DE83004781	DOE/RA/50298—T1-Bk.2
DE83004784	DOE/RA/50298—T1-Vol.3-App.
DE83004785	DOE/NV/10194—3
DE83004786	IS-T—1040
DE83004787	IS-T—1049
DE83004788	IS-T—1032
DE83004789	IS-T—1045
DE83004790	IS-T—1048
DE83004792	IS-T—1037
DE83004793	IS-T—1014
DE83004794	IS-T—1039
DE83004795	IS-T—1035
DE83004796	IS-T—1030
DE83004797	DOE/R5/10327—2
DE83004798	DOE/R5/10311—2
DE83004799	DOE/EV/03221—75
DE83004800	DOE/CH/10116—1
DE83004801	DOE/ET/29354—3
DE83004803	DOE/ET/34015—4
DE83004805	UCRL—88475
DE83004806	CONF-821212—Suppl.
DE83004807	DOE/RA/50298—T1-Vol.1
DE83004808	LA-UR—82-3584
DE83004810	LA-UR—82-3596
DE83004812	LA-UR—82-3682

Order No.	Report No.
DE83004813	DOE/ER/10428—T2
DE83004814	DOE/ER/10428—T3
DE83004815	DOE/ET/10815—75
DE83004816	DOE/ET/10815—77
DE83004817	DOE/PC/42682—T4
DE83004821	DPSP—79-1003(Del.)
DE83004838	PPPL—1964
DE83004839	Y/DV—252
DE83004844	DOE/JPL—956205-82/2
DE83004847	DOE/PC/50041—11
DE83004849	DOE/PC/30080—8
DE83004850	DOE/FE/00080—7
DE83004854	IS-T—1028
DE83004855	IS-T—1026
DE83004856	IS-T—1034
DE83004861	IS-T—1036
DE83004864	IS-T—964
DE83004865	IS-T—1031
DE83004866	IS-T—1027
DE83004867	IS-T—1025
DE83004868	DOE/EV/10611—2
DE83004869	DOE/ER/10435—2
DE83004870	DOE/EV/10270—3
DE83004871	DOE/ER/01388—883
DE83004873	DOE/CS/50108—1
DE83004875	DOE/RA/50076—1
DE83004876	DOE/RA/50076—2
DE83004877	DOE/RA/50076—3
DE83004878	DOE/RA/50076—4
DE83004879	DOE/RA/50076—5
DE83004880	DOE/RA/50076—6
DE83004881	DOE/RA/50076—8
DE83004882	DOE/RA/50076—7
DE83004885	DOE/ET/29101—33
DE83004886	PPPL—1966
DE83004887	CONF-820628—18
DE83004890	MTR—80W215-02
DE83004894	DOE/ER/12017—6
DE83004897	DOE/CS/20009—2
DE83004899	DOE/ER/10939—2
DE83004900	DOE/ER/10879—2
DE83004902	DOE/ER/12017—4
DE83004904	ONWI—400
DE83004905	DOE/ER/40048—30-L2
DE83004911	DOE/EV/72002—58
DE83004916	DOE/ER/40048—28-L2
DE83004918	DP-MS—82-48
DE83004919	DP-MS—82-49
DE83004920	DOE/ER/40048—25-L2
DE83004921	DP-MS—82-21
DE83004922	DOE/ER/40048—21-L2
DE83004923	DOE/ER/40048—20P2
DE83004924	DP-MS—82-76
DE83004926	DPST—82-969
DE83004927	DPSPU—82-30-3
DE83004928	DP-MS—82-40
DE83004929	DOE/ER/40048—17-P2
DE83004931	DP-MS—82-8
DE83004933	DOE/ER/40048—11-L2
DE83004936	CRA—489.06-Vol.1
DE83004937	CRA—489.06-Vol.2
DE83004938	IS-T—912
DE83004941	BDX—613-2874
DE83004942	BDX—613-2865
DE83004945	BDX—613-2848
DE83004946	DOE/ET/20279—170
DE83004947	MHSMP—82-47
DE83004948	DOE/CS/20544—1
DE83004949	DOE/CS/24456—2
DE83004950	LA—9445-PNTX-B
DE83004958	IS-T—1019
DE83004959	IS-T—1004
DE83004960	IS-T—988
DE83004963	IS-T—1007
DE83004964	IS-T—1000
DE83004965	IS-T—1023
DE83004967	IS-T—1009
DE83004968	IS-T—990
DE83004970	DOE/PC/50783—1
DE83004971	IS-T—959
DE83004972	IS-T—989
DE83004973	IS-T—1011
DE83004975	IS-T—1006
DE83004976	IS-T—998
DE83004977	IS-T—1022
DE83004978	IS-T—1018
DE83004979	IS-T—1017
DE83004980	IS-T—993
DE83004981	IS-T—1020
DE83004982	IS-T—963
DE83004983	IS-T—983
DE83004984	IS-T—994
DE83004985	IS-T—965
DE83004986	IS-T—951
DE83004987	CAPE—2775
DE83004988	CAPE—2776
DE83004989	CAPE—2777
DE83004990	CAPE—2778
DE83004992	UCRL—53364
DE83004993	PNL—4549
DE83004994	DOE/RG/10572—3-Vol.2
DE83004995	LA—9566-MS
DE83004996	LA—9564-MS
DE83004998	SAND—82-7066
DE83005002	ORNL/TM—8120
DE83005004	IS-T—1012
DE83005005	NUREG/CR—2425
DE83005006	SAND—82-1439C
DE83005007	SAND—82-2187C
DE83005008	SAND—82-2259C
DE83005010	DOE/ER/10065—3T
DE83005011	DOE/ID/12325—4
DE83005014	EGG-PHYS—6145
DE83005021	RFP-Trans—352
DE83005024	LA-tr—83-2
DE83005025	LA-tr—83-1
DE83005027	ORNL-tr—4934
DE83005028	UCRL—53320
DE83005029	UCRL—53298
DE83005030	PNL—4490
DE83005031	MHSMP—82-41
DE83005032	UCID—19637
DE83005033	UCID—19643
DE83005034	UCID—19640
DE83005035	SAND—82-8027
DE83005038	BMI—2101
DE83005043	DPST—82-813
DE83005044	DPST—82-854
DE83005045	DPST—82-842
DE83005047	DPST—82-839
DE83005048	MTR—82W59
DE83005049	PPPL—1951
DE83005050	PPPL—1960
DE83005051	PPPL—1961
DE83005052	PPPL—1962
DE83005056	DOE/ER/02001—T1
DE83005059	DOE/MC/14273—1318
DE83005066	DOE/ER/10740—8
DE83005067	DOE/EV/10450—T3
DE83005068	DOE/EV/10450—T2
DE83005069	DOE/EV/10450—T1
DE83005070	DOE/EV/10450—T4
DE83005071	CONF-821124—13
DE83005072	CONF-821124—12
DE83005073	Y/Sub—80-7733/1-01
DE83005075	DOE/LC/10705—T1
DE83005076	DOE/LC/RI—83-1
DE83005081	DOE/CS/40337—9
DE83005082	DOE/CS/40337—8
DE83005085	DOE/ER/10485—T2
DE83005088	DOE/JPL/955909—82/8
DE83005090	DOE/ER/53140—5
DE83005095	DOE/ET/27217—2-Vol.1
DE83005096	DOE/ET/27217—1
DE83005099	CONF-771132—7
DE83005103	DOE/NASA/20485—13
DE83005104	NRL-MR—4985
DE83005105	SERI-TP—233-1697
DE83005107	SERI/TP—235-1814
DE83005108	EGG—1183-1837
DE83005109	EGG—1183-1824
DE83005112	DOE/CS/34285—T1
DE83005113	DOE/CS/30131—T1
DE83005114	DOE/EV/10502—3
DE83005115	NRL-MR—4947
DE83005119	SAND—82-0664/1
DE83005121	BNL—31364
DE83005122	LBL—14859
DE83005123	DOE/CS/20291—4
DE83005124	DOE/CS/20009—1
DE83005125	PNL—4250-2
DE83005126	PNL—4379
DE83005132	DOE/ER/05490—37
DE83005137	DOE/ET/12548—13
DE83005138	DOE/ER/10614—2
DE83005140	DOE/JPL—1060-56
DE83005142	DOE/ET/20356—7
DE83005143	DOE/ET/12548—15
DE83005147	BNL—32188
DE83005151	ORNL/CSD/TM—191
DE83005152	ORNL/TM—8106
DE83005153	ORNL/TM—8474
DE83005154	GA-A—16848
DE83005155	ORNL/TM—8384
DE83005156	ORNL—5918
DE83005157	ORNL/TM—8374
DE83005159	ORNL/TM—8479
DE83005160	ORNL/TM—8107
DE83005161	DOE/LLW—15T
DE83005164	DOE/FC/10200—T5
DE83005165	DOE/FC/10200—T4
DE83005166	EPA—570/9-82-003
DE83005167	ORNL/SGMP—82/2
DE83005168	ORNL/CON—69
DE83005169	ORNL/TM—8589
DE83005170	ORNL/TM—8533
DE83005171	ORNL/TM—8593
DE83005172	ORNL/TM—8524
DE83005173	ORNL/TM—7855
DE83005174	ORNL/TM—8483
DE83005175	ORNL/TM—8406
DE83005176	Y—2277
DE83005177	ORNL/TM—8438
DE83005178	ORNL—5703
DE83005179	ORNL/CSD/TM—149
DE83005180	ORNL—5894
DE83005187	DOE/ER/10528—3
DE83005189	DOE/R5/10333—3
DE83005198	SAND—82-7037
DE83005199	SAND—80-1943
DE83005212	SERI/PR—234-1850
DE83005213	ONWI—334-Vol.2-App.
DE83005214	DOE/MC/14705—3
DE83005215	GTR—2913
DE83005219	UCRL—53338
DE83005221	CONF-7710248—1
DE83005226	CONF-7711157—1
DE83005232	DOE/ER/01198—1396
DE83005235	DOE/PC/40800—T2
DE83005236	DOE/ER/01198—1395
DE83005238	DOE/ET/51013—62
DE83005239	DOE/BC/10100—4
DE83005241	PNL—4580
DE83005242	DOE/NV/00410—68
DE83005243	DOE/EV/10502—2
DE83005244	SAND—80-2560
DE83005246	DOE/ET/20279—180-Vol.5
DE83005248	PNL-SA—10534
DE83005249	ONWI—399
DE83005250	SAND—82-1885
DE83005251	SAND—82-0435
DE83005253	DOE/UMT—0212
DE83005260	DOE/ID/12332—T1
DE83005265	DOE/ER/05490—32
DE83005268	DOE/ER/03285—44
DE83005269	DOE/R5/10252—2
DE83005271	DOE/EP—0081
DE83005273	DOE/ET/14804—Q7
DE83005274	EGG-TIO-M—02082
DE83005276	EGG-M—22882
DE83005277	DOE/ET/12457—T10
DE83005307	DOE/ET/10555—T1
DE83005326	DOE/ES—0004
DE83005327	BDX—613-2886
DE83005335	ONWI—348
DE83005339	DOE/CS/30013—U12
DE83005348	NUREG/CR—2966
DE83005360	SAND—82-2175
DE83005361	SAND—82-1600
DE83005362	SAND—81-1871
DE83005363	SAND—82-2393
DE83005364	SAND—81-0510
DE83005365	SAND—81-7188
DE83005377	SAND—81-7086/14
DE83005378	SAND—81-2124

Order No.	Report No.
DE83005379	SAND—81-7087/3
DE83005380	SAND—81-7080/4
DE83005381	SAND—81-7085/14
DE83005383	SAND—82-1524
DE83005390	UCRL—87491
DE83005409	DOE/CS/30013—U16
DE83005412	DOE/MC/16463—1324
DE83005440	DOE/ET/14102—4
DE83005441	DOE/ET/51013—59
DE83005452	DOE/NBB—0020
DE83005456	BNL—51606
DE83005471	IITRI-M—06087-D
DE83005474	DOE/ER/10494—4
DE83005476	DOE/PC/42681—T1
DE83005478	ONWI—9(82-1)
DE83005479	ONWI—9(81-4)
DE83005482	DOE/PC/41766—T1
DE83005489	SAND—81-7087/6
DE83005495	RHO-BW-CR—129P
DE83005498	DOE/CS/30013—U14
DE83005499	DOE/CS/30013—U13
DE83005503	MTCH-PR—7-79
DE83005506	DOE/R5/10148—1
DE83005508	UCRL—83592
DE83005509	Y/DX—103
DE83005510	UCRL—83045
DE83005511	Y/DX—111
DE83005516	SOLAR/0010—80/01
DE83005518	EGG-SD—5159
DE83005521	ORO—5197-15
DE83005522	SAN—1492-1
DE83005601	LA—9604-MS
DE83005604	LA—9601-MS
DE83005613	DOE/NASA—0241-5
DE83005619	USGS-OFR—82-478
DE83005676	BNL-NCS—28878
DE83005684	SERI/PR—8002-1-T3
DE83005840	DOE/CH/00135—4
DE83005844	DOE/CH/00135—2
DE83005845	DOE/EA—0106
DE83005846	DOE/CH/00135—1
DE83005875	EGG—1183-5101
DE83006018	ORO—5262-5
DE83006019	DOE/TIC—3386
DE83025791	CONF-801039—13
DE83780081	INIS-mf—7221
DE83780082	INIS-SU—115
DE83780084	INIS-mf—7220
DE83780113	INIS-mf—7501
DE83780123	INIS-SU—120
DE83780129	Zfl-Mitt—43a
DE83780130	Zfl-Mitt—43b
DE83780178	EUR—7441
DE83780179	INIS-mf—7423
DE83780180	INIS-mf—7431
DE83780182	INIS-mf—7461
DE83780183	INIS-mf—7463
DE83780184	INIS-mf—7433
DE83780185	INIS-mf—7434
DE83780186	INIS-mf—7454
DE83780187	INIS-mf—7457
DE83780188	FRNC-TH—1063
DE83780190	INIS-mf—7424
DE83780191	FS—79-19-AKD
DE83780192	INIS-SU—126
DE83780197	INIS-mf—7224
DE83780216	INIS-mf—7432
DE83780217	INIS-SU—104
DE83780218	INIS-mf—7218
DE83780227	INIS-SU—119
DE83780237	INIS-mf—7225
DE83780238	INIS-SU—121
DE83900030	NUREG—0952
DE83900031	NUREG/CR—3040
DE83900032	RISLEY-Trans—4167
DE83900184	NDRE/PUBL—81/1003
DE83900306	CONF-811175—
DE83900363	TVA/OACD—83/2
DE83900365	BLG—549
DE83900369	NP—3900369
DE83900401	NP-tr—3900401
DE83900452	RISLEY-Trans—4186
DE83900458	NUREG—0820
DE83900459	NUREG—0750-Vol.15-No.6
DE83900466	RISLEY-Trans—4174
DE83900468	OA-tr—2517
DE83900584	RRC—49
DE83900588	BMFT—150-423-Pt.1
DE83900590	KFK-tr—673
DE83900591	EIR—432
DE83900592	NUREG—0606-Vol.4-No.4
DE83900598	BMFT-RS—150-365-Pt.3
DE83900599	BMFT-RS—150-365-Pt.2
DE83900600	BMFT-RS—150-365-Pt.1
DE83900639	EPRI-NP—2637
DE83900684	TENRAC/EDF—038-Vol.1
DE83900695	TENRAC/EDF—039
DE83900700	UT/CES-PS—20
DE83900701	NUREG/CR—3066
DE83900707	NUREG—0912
DE83900709	NUREG—0139-Suppl.1-Vol.1
DE83900710	NGD—12-1981-R-O
DE83900721	NUREG/CR—2558
DE83900733	EPRI-EA—2e39-SR
DE83900740	EPRI-NP—2646
DE83900741	EPRI-NP—2638
DE83900751	EPRI-NP—2701
DE83900752	EPRI-NP—2706
DE83900753	EPRI-NP—1401-Vol.3
DE83900765	NP-tr—3900765
DE83900769	NP-tr—3900769
DE83900778	NUREG—0871-Vol.1-No.4
DE83900786	TENRAC/EDF—009
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DE83900808	TENRAC/EDF—080
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DE83900837	INFN/AE—82/4
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DE83900858	RIFP—466
DE83900866	CRN—82-01
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DZ	Algeria
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HV	Upper Volta
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IE	Ireland
IG	Inter-Governmental Maritime Consultative Organization
II	International Commission on Radiation Units and Measurements
IL	Israel

IN India
IO International Labor Organization
IP International Union of Pure and Applied Physics
IQ Iraq
IR Iran
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IX International Union of Pure and Applied Chemistry

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KH Cambodia
KP Democratic People's Republic of Korea
KR Korea, Republic of
KW Kuwait

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LY Libyan Arab Republic

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MV Maldives
MW Malawi
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NO Norway
NP Nepal
NR Nauru
NZ New Zealand

OE Organization for Economic Cooperation and Development
OM Oman

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PE Peru
PG Papua New Guinea
PH Philippines
PK Pakistan
PL Poland
PR Puerto Rico
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PY Paraguay

QA Qatar

RH Southern Rhodesia
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SV El Salvador
SY Syria
SZ Swaziland

TC Trucial Oman
TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UE United Nations Educational, Scientific and Cultural Organization
UF United Nations Children's Fund
UG Uganda
UI United Nations Industrial Development Organization
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Viet-Nam
VE Venezuela
VS Republic of Viet-Nam

WM World Meteorological Organization
WS Western Samoa

XA International Atomic Energy Agency (IAEA)
XC European Organization for Nuclear Research (CERN)
XE Commission of the European Communities (CEC)
XF Food and Agriculture Organization of the United Nations (FAO)
XJ Joint Institute for Nuclear Research (JINR)
XM Council for Mutual Economic Assistance (CMEA)
XN Nuclear Energy Agency of the OECD (NEA)
XO Organization of African Unity (OAU)
XR International Commission on Radiological Protection (ICRP)
XS International Organization for Standardization (ISO)
XU United Nations (UN)
XW World Health Organization (WHO)
XX World Energy Conference (WEC)

YD Democratic Yemen
YE Yemen
YU Yugoslavia

ZA South Africa
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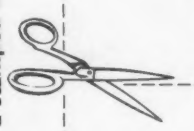

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